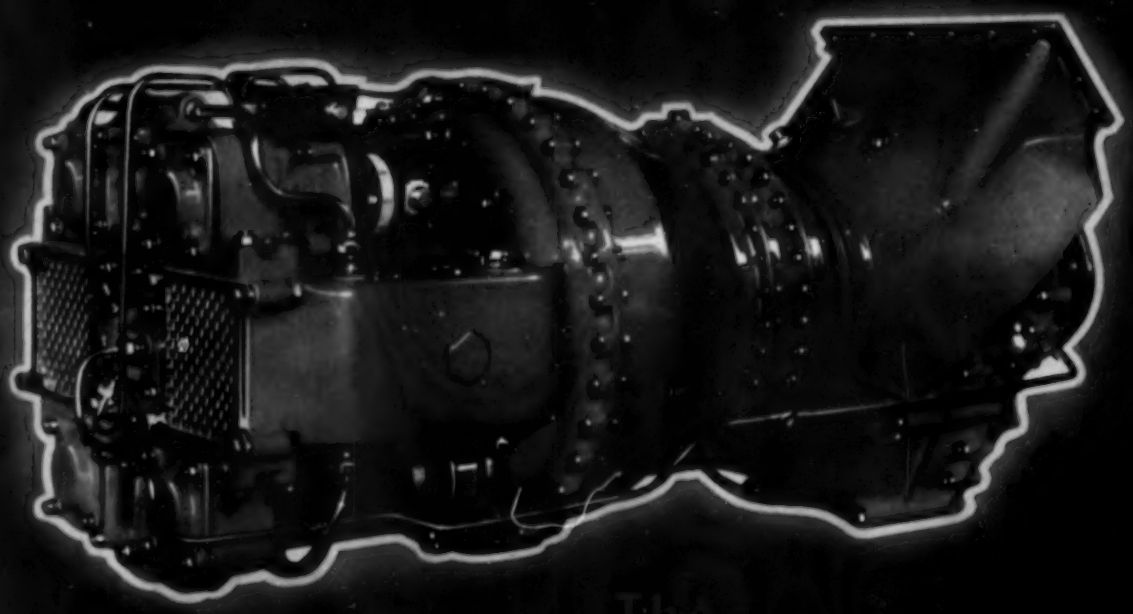
3 JUNE, 1955 ONE SHILLING & SIXPENCE

# FLIGHT

and

AIRCRAFT ENGINEER

OFFICIAL ORGAN OF THE ROYAL AERO CLUB



The
TURMO
FREE TURBINE

Blackburn and General Aircraft Limited

ENGINE DIVISION

43 BERKELEY SQUARE, LONDON, W.1

THE TORCH OF INDUSTRY

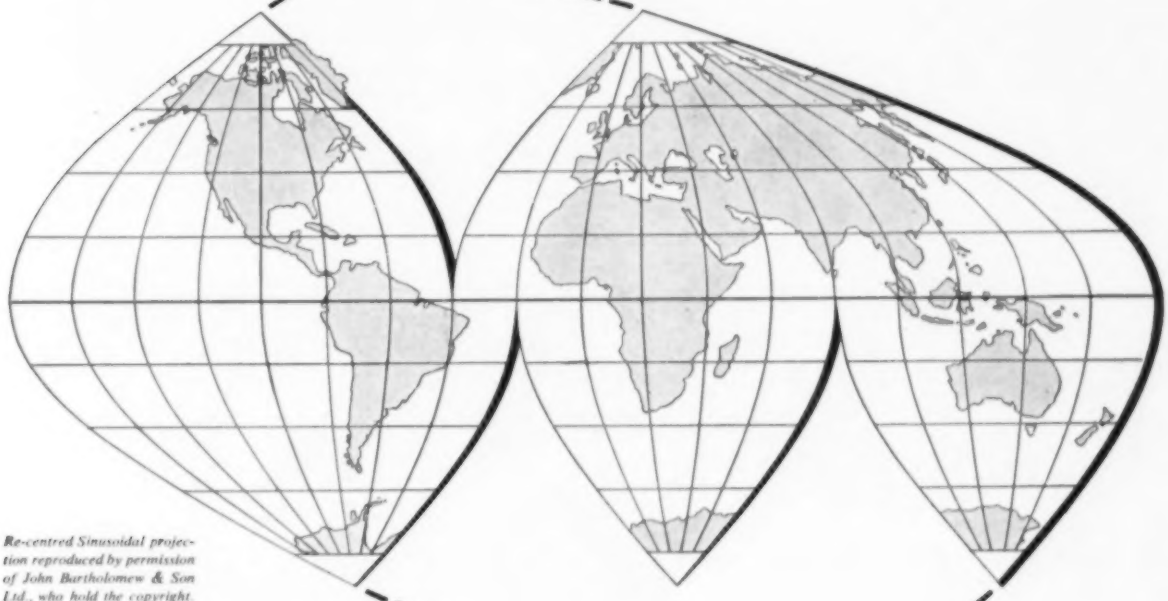
## EFFICIENCY IN FLAME HARDENING

The photograph shows a starter ring being flame-hardened at the works of the Francis B. Willmott Group.
This machine was built with the assistance of BOC staff and uses BOC flame hardening equipment.
The BOC makes a standard range of flame hardening machines and will always assist in helping customers with their specialised requirements.
*For fuller details write to your nearest BOC branch for Technical Information Booklet No. 13.*

*Photograph by courtesy of the Francis B. Willmott Group.*

BOC BRITISH OXYGEN

# GLOBAL PROJECTION OF VISCOUNT SUCCESS



*Re-centred Sinusoidal projection reproduced by permission of John Bartholomew & Son Ltd., who hold the copyright.*

# 200

From BEA come further orders for 11 more Viscounts, taking the total past the double-century. From BEA, Air France and Aer Lingus comes word of the aircraft's record-breaking popularity and efficiency . . . from TCA in Canada the news that the passenger appeal of the Viscount is as great on that side of the Atlantic as on this . . . TAA in Australia send reports of record utilisation. An established success in the Old World, is now projected to the New World, and will soon be justifying the confidence of its operators in every part of the globe.

**£36,000 Per Aircraft Per Year**

The BEA Viscounts during the year 1954/1955 each made a profit of £36,000 ($100,000).

**VICKERS VISCOUNT**

FOUR ROLLS-ROYCE DART PROPELLER-TURBINE ENGINES

VICKERS-ARMSTRONGS LIMITED · WEYBRIDGE · SURREY

AT 50a

*By courtesy of The Daily Express*
*Friday 13th May, 1955.*

*Every Viscount nets profit of £38,000*

By W. A. WATERTON

FOR the first time in its eight years' life, British European Airways has made a profit for the taxpayers—thanks to the Viscount airliner.

These glistening Rolls-Royce turbo-propeller planes, flying on the "plum" routes, showed a profit of £38,000 each last year.

On the last reckoning (1953-54) B.E.A. lost £1,700,000. Even the executives had little hope of getting "out of the red" till after 1956. But they did.

Lord Douglas of Kirtleside, B.E.A.'s chairman, announced yesterday that the corporation made just over £30,000 clear profit for 1954-55.

Gross profit was nearly

*The money-spinner.*

£750,000. Fuel tax paid was £400,000.

Lord Douglas put down the achievement to the replacement of Vikings by Viscounts and Ambassadors, and a big economy drive.

He said that his earlier hopes for helicopters were too optimistic. "I have recently been to America and seen their large helicopters — their ... further off than I thought some time ago."

*(Last July Lord Douglas thought they would be in service in 1952-53.)*

... turbo ... replacement for the Dakotas and five Rapides still used by the corporation. "We want them to be B... built," he said.

Lord Douglas ... a plan by the British Transport Commission to take passengers from London to ... Airport by rail—by ... a line from Feltham to the airports.

"... reach the central ... a tunnel," he said. "... passengers would use Waterloo ... But it's a long way ... maybe 10 years."

# and all B.E.A. Viscounts are DECCA fitted

THE DECCA NAVIGATOR COMPANY LIMITED, LONDON

# Problems in Parallel

The considerations that have led to the adoption of Seamews for the Royal Air Force and the Royal Navy are of more than domestic significance. N.A.T.O. countries with long coastlines and islands to defend against submarines require large numbers of search-and-strike aircraft. They are needed to carry out *continuous* coastal patrols—probably from makeshift air strips—and to provide anti-submarine 'umbrellas' for convoys passing through coastal waters.

*Aircraft for this purpose do not require great speed but they must be:*

- Simple to build—so that they may be provided in numbers at low cost and their production widely dispersed as a measure of protection against atomic attack.
- Simple to operate—so that they could, if necessary, be flown and serviced by reservists with the minimum of training.
- Rugged in construction—so that they can take off and land with ease on anything from an emergency landing-strip, on a beach or golf course, to the heaving deck of a small escort carrier in heavy weather.
- Efficient in operation for both search and strike.

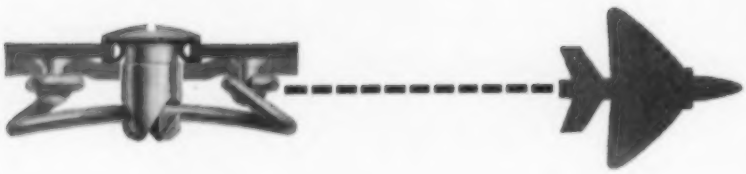
*The Short Seamew fulfils all these requirements.*

**The *Short* answer is the *Seamew***

**Now in production for the Royal Air Force and the Royal Navy**

*CAPS KEY*
*The caps shown are those of the Commander-in-Chief, Allied Forces Mediterranean, and the senior officers on his staff.*

SHORT BROTHERS AND HARLAND LTD., QUEENS ISLAND, BELFAST, N. IRELAND
*The first manufacturers of aircraft in the world; specialists in maritime aircraft since 1910*



*As familiar in outline as the many famous aircraft in which they are used...*

**DZUS**
**FASTENERS**
**DEPENDABLE SAFE ACCESSIBLE**

DZUS FASTENER EUROPE LIMITED, FACTORY ESTATE, GUILDFORD ROAD, FARNHAM, SURREY
*Sales Agents in the U.K.:*
THOMAS P. HEADLAND LIMITED, 164-168 WESTMINSTER BRIDGE ROAD, LONDON, S.E.1

---

TO *Aircraft, Aero Engine and Accessory Manufacturers*

*Our Machine Shops are laid out for:—*

- **EXPERIMENTAL MACHINING**
- **DEVELOPMENT WORK**
- **PRODUCTION** *LONG OR SHORT RUNS*

When required our Toolrooms will design and manufacture all necessary
**JIGS & FIXTURES**

We can work to the finest limits on the
**FINEST MACHINE TOOLS**

Capacity for
**VERY LARGE COMPONENTS**

*Fully A.I.D. Approved*
*Ref. No. 793672/38*

*Reasonable prices.*
*Prompt deliveries.*

Send your enquiries to:

Leytonstone JIG & TOOL Co Ltd

LEYTOOL WORKS, HIGH ROAD, LEYTON, LONDON, E.10

*Phone: Leytonstone 5022-4*

PHOTOGRAPH BY COURTESY OF "FLIGHT"

*To our many friends who will be visiting Paris on this occasion we extend a cordial welcome to our Stand No. 55 where a full range of Hobson equipment will be displayed.*

**Hobson**

**21e SALON INTERNATIONAL DE L'AERONAUTIQUE**
**LE BOURGET, PARIS · JUNE 10th TO 19th, 1955**

**H. M. HOBSON LIMITED · FORDHOUSES · WOLVERHAMPTON**

*Licensees in U.S.A.: Simmonds Aerocessories Inc., Tarrytown, NEW YORK, U.S.A.*

*Agents in France: Societe Commerciale et Industrielle Franco - Britannique, 48 Avenue Raymond Poincare, PARIS XVI.*

*Licensees in Italy: Secondo Mona, SOMMA LOMBARDO.*

*Agents in Australia: Aeronautical Supply Co. Pty. Ltd., 210 Victoria Street, MELBOURNE, Victoria.*

*Agents in Spain: Senor Ramon Escario, Nunez de Balboa, 29, MADRID.*

*Agents in Egypt and Syria: T. G. Mapplebeck, 48, Sharia Abdel-Khalek Sarwat Pasha, CAIRO, Egypt.*

*Agents in Israel: Curt Israel, P.O.B. 1999, TEL AVIV.*

TEDDINGTON AIRCRAFT CONTROLS LTD.

**Navigation Light Flasher Unit**

which has received

unrestricted A.R.B. approval

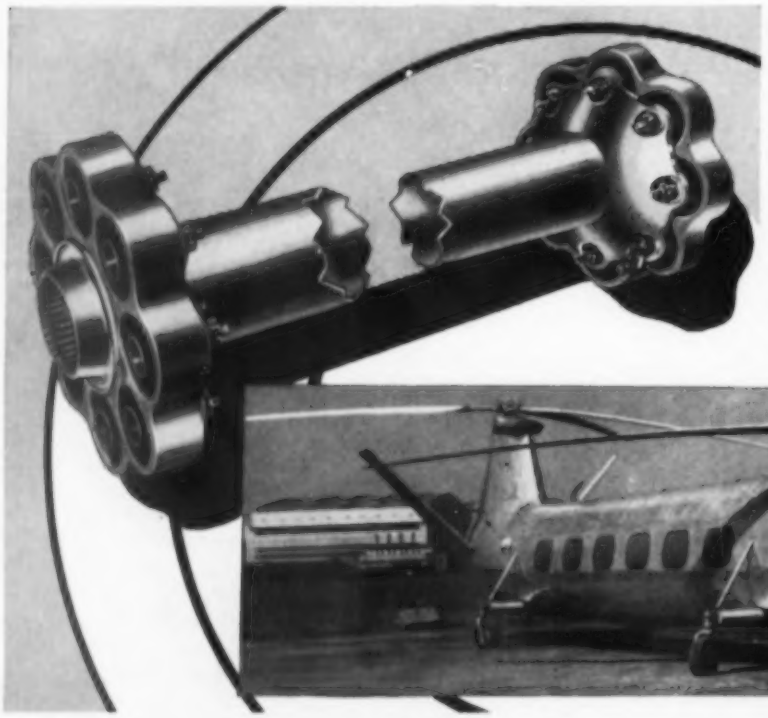
**Designed to meet the requirements of British Standard Specification G 137, the Teddington Navigation Light Flasher Unit has received unrestricted A.R.B. approval and is now in production. Using the Teddington 24 volt D.C. constant speed motor for driving the switch mechanism, the FOG/A/2 has an overhaul life of 3,000 flying hours and weighs only 1.5 lbs. The Navigation Lights are automatically switched to 'steady' should the motor circuit fail.**

| | | | |
|---|---|---|---|
| Weight | 1.5 lbs | Acceleration | B.S.G. 100 Grade 2 |
| Voltage | 22—28 volts D.C | Climatic Proofing | B.S.G. 100 Grade 1 |
| Motor Rating | 0.2 amps | Radio Interference | E.L. 1716 |
| Flasher Contact Rating | 80 watts | Compass Safe Distance | 15" |
| Ambient Temperature Range | —65°C to + 70°C | Diameter | 2.75" |
| Vibration | B.S.G. 100 Grades 2 & 3 | Overall- Length | 6.00" |

Teddington CONTROLS

TEDDINGTON AIRCRAFT CONTROLS LTD., MERTHYR TYDFIL, SOUTH WALES Telephone: Merthyr Tydfil 666

London Office: 51 BROMPTON ROAD, S.W.3 Telephone: KENsington 4808.



# *Up or down*

**Both the 'Bristol' Type 173 Twin Rotor Helicopter and the 'Bristol' Type 171 Sycamore Helicopter use LAYRUB as the main drive between engines and rotors.**

**The Layrub Couplings use rubber trunnion blocks as the main driving elements. There are no metal-to-metal contacts; the drive being fully cushioned. No lubrication is required, therefore little maintenance.**

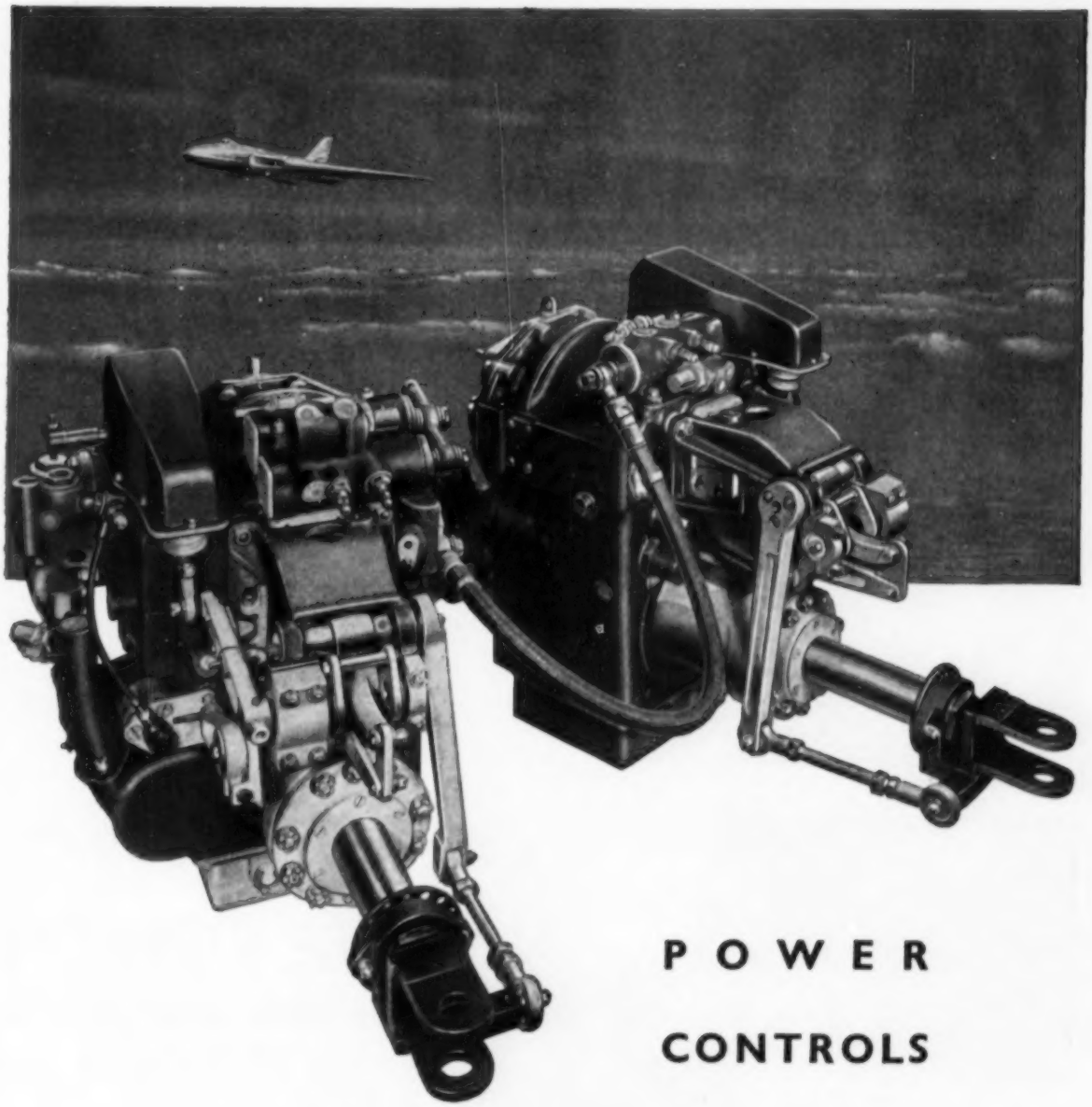
**Layrub has been the means of solving many transmission problems, perhaps it can solve yours?**

**Other famous British Aircraft in which Layrub is used either as auxiliary or main drive include the 'Saunders-Roe Princess,' 'Bristol Britannia,' etc.**

**A postcard will see full technical date on its way to you.**

LAYCOCK ENG. LTD., MILLHOUSES, SHEFFIELD 8

Layrub serves shock free without lubrication



# POWER CONTROLS

BOULTON PAUL power controls are characterised by their *SENSITIVITY*, independent of aerodynamic loads; *FIDELITY* of response under all normal conditions of loading and rates of operation; *STABILITY*, inherent in the design; *PRECISION* in manufacture and performance; *SAFETY*, positively ensured by duplication of fundamental components; *RELIABILITY*, proved by a long history of trouble-free service; and *VERSATILITY*, enabling the system to be applied in widely varying arrangements to suit the requirements of individual aircraft designs. The dual unit illustrated operates the rudder of the Avro Vulcan bomber.

# BOULTON PAUL AIRCRAFT LTD

WOLVERHAMPTON, ENGLAND

P.C.9.

# Jet pipe

FOR **FOKKER F.27**
*"FRIENDSHIP"*

Joseph SANKEY AND SONS. LIMITED.
ALBERT STREET · BILSTON · STAFFS

SPECIALISTS IN THE MANUFACTURE OF COMPLETE GAS TURBINE ASSEMBLIES, SUCH AS EXHAUST SYSTEMS, COMBUSTION CHAMBERS, ETC., IN STAINLESS STEEL AND HEAT RESISTING MATERIALS

# T.T. NUMBERS!

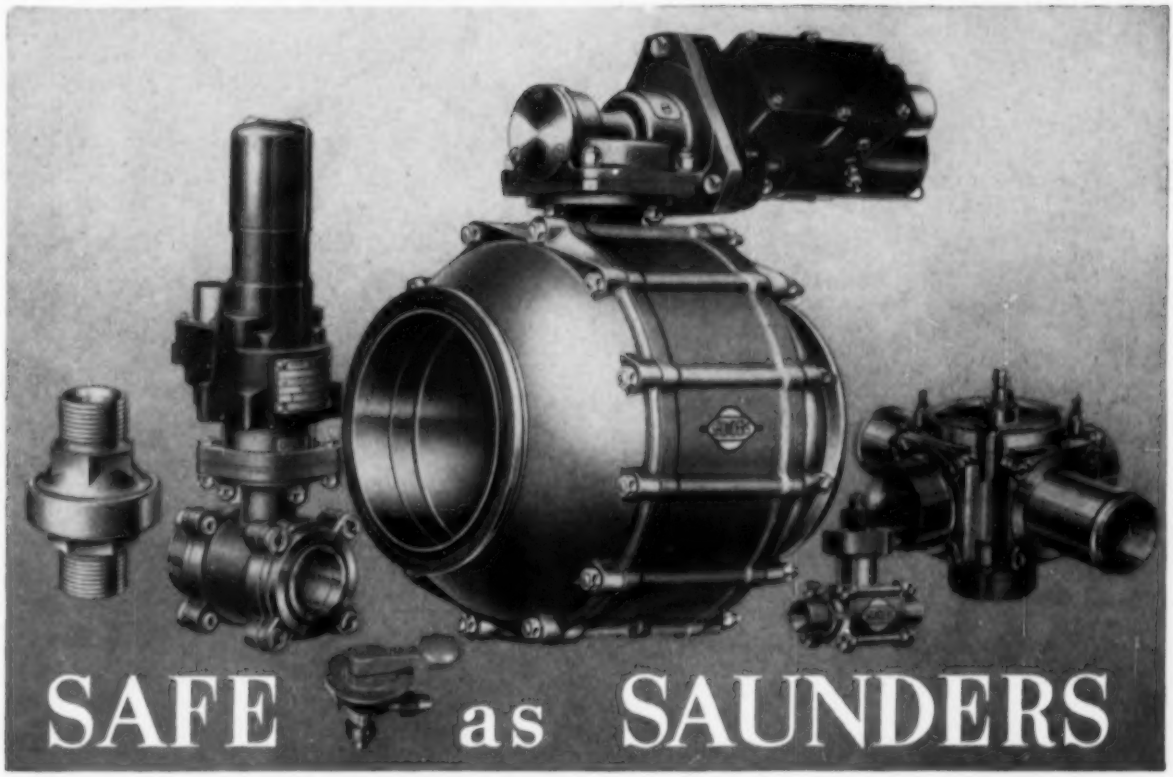
**—unrivalled description and pictures of this great event**

The MOTOR CYCLE's superb T.T. numbers bring you this year's thrills lap by lap, rider by rider. Follow every moment of the greatest annual event in the motor cyclist's calendar with The MOTOR CYCLE's on-the-spot team of writers and photographers. Each issue 8d. as usual.

*ORDER YOUR COPIES NOW*

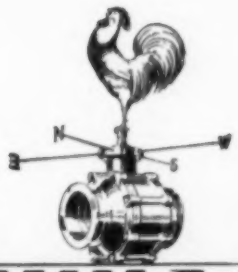
THE MOTOR CYCLE

**T.T. NUMBER JUNE 9. T.T. REPORT JUNE 16**



# SAFE as SAUNDERS

Saunders Flexible diaphragm sealing, approved for the safety it introduced to the control of fuel and oil systems, is today handling, with the same sureness, the many other fluids encountered in modern aviation, e.g.—oxygen, nitrogen, hot air, methanol water, ethylene, glucol, de-icing fluids and domestic and drinking water.




**SAUNDERS AERO COCKS**

Examples of the wide range are illustrated above.

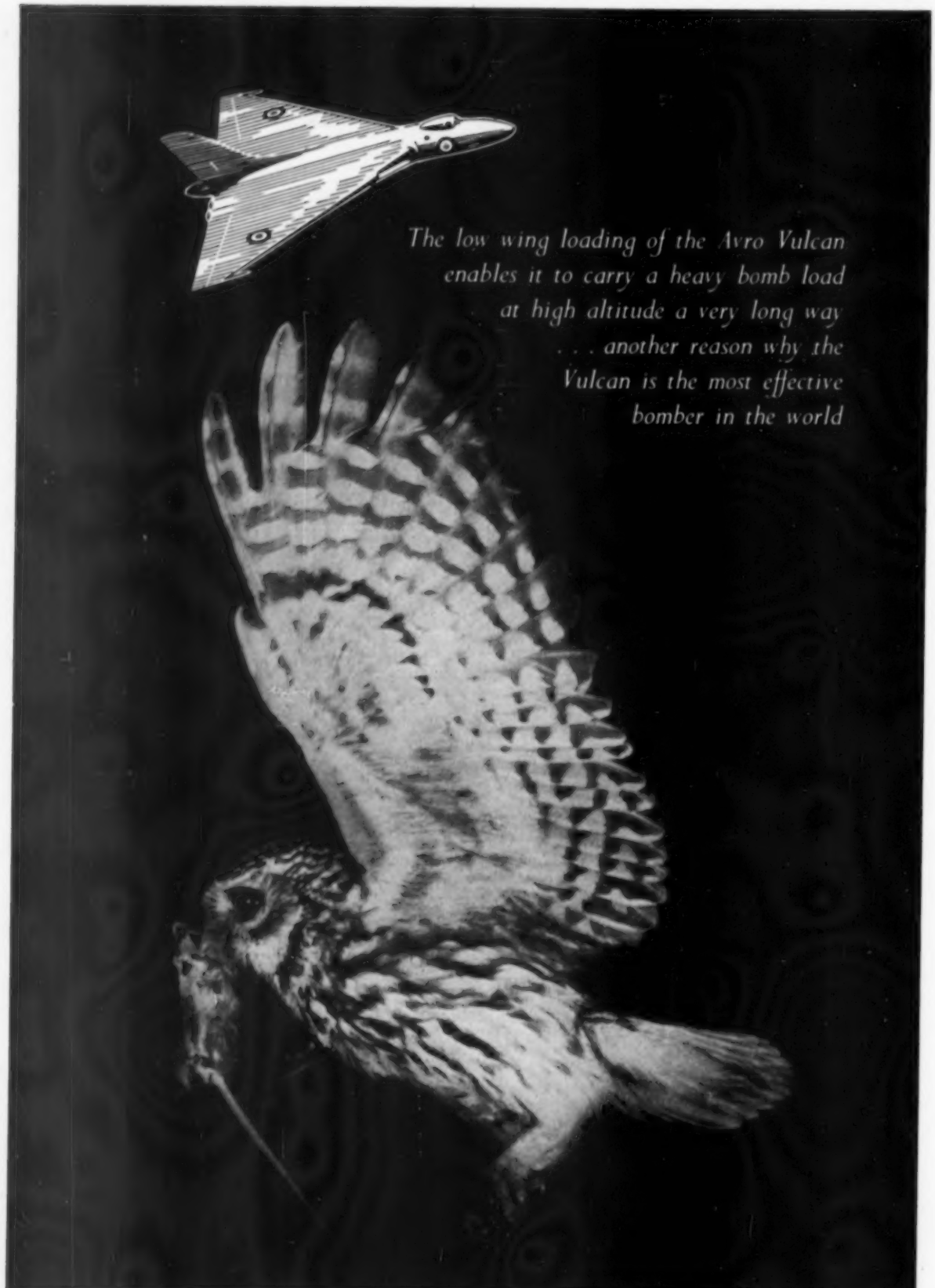
(1) Non-return Valve, with spring-loaded or 'free' check plates to operate in any position. (2) 1 in. Spherical Plug Cock with triple diaphragm sealing fitted with electrical actuator in circuit with cockpit or engineer's switch. (3) 4 in. bore S.P. Cock with cored body and plug and with geared actuator drive permitting snug assembly—the largest fuel cock made. (4) ¾ in. bore S.P. Cock—the other extreme in the range and incorporating the same sure triple diaphragm sealing. (5) S.P. Multiway Cock for the simplification of plumbing on modern commercial aircraft. (6) Self-closing diaphragm water tap, stainless steel body and diaphragm are the only parts in contact with water. Unaffected by chlorinating or sterilizing processes.

SAUNDERS VALVE COMPANY LIMITED

AIRCRAFT DIVISION

BLACKFRIARS STREET · HEREFORD

C


The low wing loading of the Avro Vulcan
enables it to carry a heavy bomb load
at high altitude a very long way
. . . another reason why the
Vulcan is the most effective
bomber in the world

*Little Owl photographed by Eric Hosking. Taken by high-speed flash with a specially constructed set giving 680 joules with two lamps at an exposure of 1/5,000th second at f/45.*

FLIGHT
and
AIRCRAFT ENGINEER

First Aeronautical Weekly in the World

Founded 1909

No. 2419 Vol. 67. FRIDAY, 3 JUNE 1955

EDITOR
MAURICE A. SMITH, D.F.C. and Bar

ASSOCIATE EDITOR
H. F. KING, M.B.E.

TECHNICAL EDITOR
W. T. GUNSTON

ART EDITOR
JOHN YOXALL

Editorial, Advertising and Publishing Offices:

DORSET HOUSE,
STAMFORD STREET,
LONDON, S.E.1.

*Telegrams, Flightpres, Sedist, London.*
*Telephone, Waterloo 3333 (60 lines).*

Branch Offices:

COVENTRY
8-10, Corporation Street.
*Telegrams, Autocar, Coventry.*
*Telephone, Coventry 5210.*

BIRMINGHAM, 2
King Edward House,
New Street.
*Telegrams, Autopress, Birmingham.*
*Telephone, Midland 7191 (7 lines).*

MANCHESTER, 3
260, Deansgate.
*Telegrams, Iliffe, Manchester.*
*Telephone, Blackfriars 4412 (3 lines).*
*Deansgate 3595 (2 lines).*

GLASGOW, C.2.
26b, Renfield Street.
*Telegrams, Iliffe, Glasgow.*
*Telephone, Central 1265 (2 lines).*

SUBSCRIPTION RATES
Home and Overseas: Twelve months £4 10s. U.S.A. and Canada, $14.00.

IN THIS ISSUE:

Bristol Orpheus - - - 751
Blackburn-Turboméca - 753
Whitsun Displays and Competitions - - - 760
Fokker F.27 Friendship 762
Farewell to "Habb" - 768
Lockheed v. Douglas - 771
Louis Bréguet's Work —an Appreciation - 773
Soldering Aluminium - 774

## Pall over the Pentagon

GREY as was the Moscow sky which precluded the May Day fly-past by the Red Air Force, it was bright compared with the gloom now prevailing in some quarters of the Pentagon and Senate. American observers had, quite rightly, been expecting some considerable increments in technical efficiency and numerical strength since the previous year; but they were left aghast by what did, in fact, materialize in the fly-past rehearsals.

The text of a Department of Defence announcement was in characteristic departmental vein: ". . . observations established a new basis of our estimate of Soviet production of the heavy jet bomber and of the medium bomber. There has also been an appearance of a turboprop bomber, and a new all-weather fighter has appeared, as expected. This knowledge is evidence of the modern technology of the Soviet aircraft industry and the advances which are being made by them . . ." But this pronouncement was followed by declamations such as that of Senator Stuart Symington, former Secretary of the Air Force, and member of the Senate Armed Services Committee. "I am shocked and astounded," he said, "upon learning more about the announcement by the Department of Defence. . . . It is now clear that the United States, along with the rest of the free world, may have lost control of the air except for the possibility that we still have advantages in base location and training." The Senator added that in quality, as well as in quantity, of aircraft the Communists are at least in the process of surpassing the U.S.A., and he was certain, too, that they were well ahead with the production of the "possible ultimate weapon," the inter-continental ballistic missile.

To square the record, we must add the more recent contention of Mr. Charles Wilson, U.S. Secretary of Defence, that the United States still has air superiority over the Soviet Union, and that she intends to maintain it; though parenthetically he added that it would be foolhardy to deny that the Russians were likewise improving "in technology and production." Symptomatic of that improvement is the record (unofficial but probably a fair approximation) of participation in the May Day rehearsals.

### Seeing is Believing

Fully as disquieting as the show of jet-bomber strength was the fighter representation, outstanding among which was a formation—at least 50 strong, according to reports—of new single-seat fighters, having mainplanes swept back at 60 deg and tailplane set low on the fuselage, indicative of level-supersonic performance. There were, too, straight-wing all-weather intercepters, some 30 in number, of a type never before seen in the fly-past. Of Mig-15s and Mig-17s there appear to have been none, which may indicate a desire to exhibit only the very latest and best equipment on hand.

Surprising, in view of known pure-jet developments, were the turboprop bombers, impressive four-engined machines, though less disturbing than the ten "Bison" four-jet heavy bombers (approximating in size and capacity to the Boeing B-52), of which only a solitary example appeared last year. Completing the cavalcade were some 50 "Badgers"—very powerful twin-jet medium bombers, generally compared in America with the B-47, though probably of later design. Of these, only nine were observed last year.

Considered either in the aggregate or individually, these new aircraft represent technical achievements of a very high order indeed, though we ourselves incline to the view of Mr. Roger Lewis, Assistant Secretary of the Air Force, that the U.S.A.F. has machines of better quality. Certainly in the Lockheed F-104 she possesses a fighter of such advanced characteristics that no pictures or particulars have been officially released. But Soviet observers are likely to scan the skies in vain for squadrons of these machines in the coming months—even, we venture to predict, on U.S. Armed Forces Day, 1956.

# FROM ALL QUARTERS

## The Paris Salon

MILITARY and civil aircraft of exceptional interest, apart from 180 static exhibitors representing the airframe, power-plant and equipment industries of ten nations, are promised for the 21st International Aeronautical Salon, which opens at Le Bourget Airport, Paris, on Friday, June 10th, and continues until Sunday, the 19th.

The great Exposition Hall, now enlarged to an area of over 107,000 sq ft, will be surrounded by an aircraft park, wherein visitors will be free to circulate.

Participating countries are France, Great Britain, the U.S.A., Germany, Belgium, Holland, Italy, Luxembourg, Poland and Czechoslovakia. Notable French aircraft will include the Dassault Mystère IVA and IVN, the Super Mystère and the M.D.550 fighters; three twin-jet S.O.4050 Vautour multi-purpose aircraft; the S.O.9000 Trident turbojet-*cum*-rocket research fighter; the S.E.210 Caravelle twin-Avon airliner; two S.E.5000 Baroudeur trolley-launched attack aircraft; the S.E. Aquilon naval all-weather fighter (Sea Venom development); the Nord 1402B Gerfaut turbojet research intercepter; Nord 2501 Noratlas transport; Nord 3200 trainer; Bréguet 763 Deux Ponts heavy freighter; Hurel Dubois H.D.31 and H.D.32 high-aspect-ratio twin-engined transports (three aircraft); Fouga 170R Magister jet trainer; Morane Saulnier M.S.755 Fleuret jet trainer; Sipa S.200 and S.300 jet trainers; and Payen Pa 49 delta-wing research aircraft.

Britain's contribution will include the Bristol Britannia 100 civil transport; Avro Vulcan B.1 bomber; Gloster Javelin FAW.1 all-weather fighter; Hawker Hunter F.4 intercepter; English Electric Canberra B.8 interdictor and T.4 trainer; and three Fairey Gannets—two A.S.1s and a T.2. Italy is sending the Fiat G.82 and Holland the Fokker S.14—both jet trainers.

The Salon will be inaugurated, on June 10th, by the President of the French Republic, and the following day will be an International Commercial Aviation Day, during which the public will be able to view the most modern civil aircraft now in use or about to enter service. Monday, the 13th, will be devoted to helicopters, and on Wednesday, the 15th, more than a hundred privately-owned machines are scheduled to arrive at Le Bourget after a week-long rally across France and the neighbouring countries, in commemoration of the F.A.I.'s 50th anniversary. Saturday, the 18th, will be marked by a flying display for guests of the Union Syndicale des Industries Aeronautique and the public will be able to watch this from special enclosures.

The biggest day of all, however, is the last—Sunday, June 19th—when all the latest prototypes will be demonstrated in flight. On this occasion the Air Forces of France, America and Britain will be represented in strength; three aerobatic teams will perform, and there will be delayed-action parachute drops.

More than 600 Pressmen from almost every country in the world are expected.

## Titanium—Red View

SPEAKING on East German radio, Maj. Egbert von Frankenberg, described as "an air expert", stated that "through an indiscretion of the Danish Air Force" a secret, hitherto suppressed so as not to undermine air-crew morale, had been revealed; namely, that the operational life of British and American fighters was "down to 80 hours". He attributed this to the incidence of fatigue, and went on to claim that this airframe wastage also affected the forces of the "peace camp", but that the latter, owing to their superior economy and social system, were able to turn out large quantities of titanium alloys with high resistance to the effects of fatigue and high temperature.

The broadcaster spoke of the troubles experienced at Mach numbers of the order of two, and claimed that the Communist countries had made greater progress than had the West in designing airframes for such conditions. "Western research," he said, "was making no progress in developing new methods of production of titanium"; and commercially pure metal still cost America $139 per pound. The Republic F-84F was named as a machine dangerously deficient in titanium alloy.

## Directorship for Dr. E. S. Moult

THE de Havilland Enterprise announced yesterday that Dr. E. S. Moult, Ph.D., B.Sc., M.I.Mech.E., F.R.Ae.S., chief engineer of the de Havilland Engine Co., Ltd., has been appointed to the Board of that company. His title in his new post will be that of "director and chief engineer." Dr. Moult, who is 52 years of age, has been concerned with aero-engine design from a time soon after the First World War, and in the inter-war years was associated with the late Major F. B. Halford in the design and development of such famous engines as the D.H. Gipsy and the Napier Rapier, Dagger and Sabre. He became chief engineer of the engineering departments of the de Havilland engine and propeller divisions in 1941 and on the formation of the engine company in 1944 was appointed its chief engineer. He was a member of the Council of the R.Ae.S. in 1951-53.

*Dr. Moult.*

*CANBERRA, LINCS: Pending the arrival in strength of the first Vickers Valiants, the strength of R.A.F. Bomber Command lies in its English Electric Canberras, wherein the B.6 variant, portrayed in this new "Flight" photograph, secured over Lincolnshire, is now predominant.*

*CRANES enter into both these pictures—on the right an American roadable giant weighing 48 tons and seen lifting the 30-odd tons of a Navy Privateer; below, a dockyard crane at Avonmouth hoisting a Bristol Sycamore, Canada-bound, aboard the freighter "Gloucester City." The helicopter had been flown from Filton and landed on the quay.*

## Air-India Constellation Inquiry

SABOTAGE was responsible for the loss of Air-India Constellation VT-DEP on April 11th, according to an Indonesian Government report published on May 26th. The report said that an inspection of the wreckage revealed evidence of an explosion in the starboard wheel-well "of a timed infernal machine, parts of which were still trapped in the wreckage." Britain's representative at the inquiry has expressed his agreement with its findings, and the Hong Kong police investigation into the affair has been intensified.

The Constellation, it will be recalled, fell into the South China Sea, within Indonesian waters, while on a flight from Hong Kong to Djakarta, carrying Chinese Communist delegates to the Afro-Asian conference at Bandung. All of the 11 passengers and five of the crew of eight lost their lives.

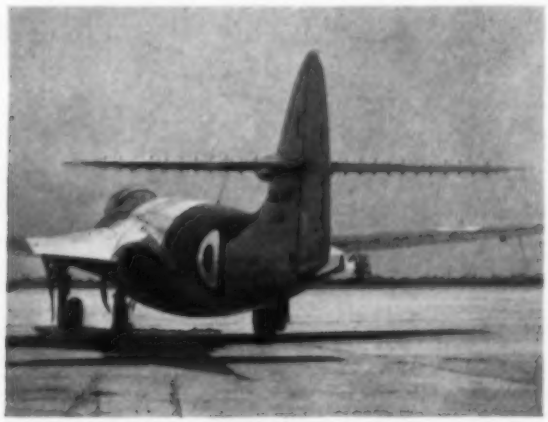
## Dollar Aid for Pakistan

THE programme of aid for Pakistan International Airlines announced recently by the American Foreign Operations Administration is the first U.S. Government technical-assistance project to use aviation as a means of stimulating the industrial and economic growth of an undeveloped region. Assistance to P.I.A. will take the form of a 24-man team of specialists from Pan American Airways who, for the next three years, will serve the Pakistani airline in the following departments: operations, pilot training, dispatch, communications, maintenance, traffic and sales, passenger service, treasury and accounting, and services of supply.

The project is expected to cost $2.9m (just over £1m), of which America will pay $2.5m, the Pakistan airline making up the balance. In addition, the Foreign Operations Administration is contributing almost $1m towards the cost of providing Pakistan with new airport and air-route facilities.

Commenting on the project, Mr. M. A. Ispahani, chairman of P.I.A., has expressed certainty that, with American assistance, the Corporation "will soon grow into a major carrier which will be a source of strength to Pakistan and the free world." The effects of the American aid programme will be felt in commercial as well as technical aspects of the airline's operations; in particular, it is expected that modern methods of market research, route analysis and sales promotion will have a strong influence on P.I.A.'s future development.

*VORTEX GENERATORS on the tail of this Armstrong-Whitworth-built Hawker Sea Hawk have been fitted "to test the longitudinal stability at high Mach numbers," as part of an attempt to raise the speed of this F.A.A. fighter/ground-attack aircraft.*



## Maj-Gen. Sir John Capper

WE regret to record the death, on May 25th, of Maj-Gen. Sir John Capper. He was 93 years of age. From 1903 to 1910 he was Commandant of the Army Balloon School (previously commanded by the famous Col. J. L. B. Templer, who had made experiments with military balloons at Woolwich in the 1870s) and from 1906 to 1909 superintendent of the Balloon Factory at Farnborough, which was ultimately to become the Royal Aircraft Establishment. In 1907, working with S. F. Cody, he superintended construction of the first British military airship, *Nulli Secundus*, and, accompanied by Cody, he was its pilot when, in October of that year, it made a flight over London. This was both the first flight over the capital by a military airship and the longest airship flight to that date, having lasted three-and-a-half hours.

In 1904, as a colonel, Capper had gone to North Carolina to persuade the Wright brothers to continue their experiments in this country; but the scheme fell through because of lack of financial support from the Government.

In subsequent years, Gen. Capper took a leading part in many of the early experiments with airships and aeroplanes, both as a pilot and technician. He flew the Dunne D.1 at Blair Atholl in 1907 and was in the balloon *Pegasus* when the first successful ground-to-air radio transmissions were received in 1908. His appointment at the Balloon School ended in October 1910 and he became Commandant of the School of Military Engineering. At the end of World War I, he was Director-General of the Tank Corps and was its Colonel Commandant from 1923-34.

It is of interest to quote some observations of Col. Capper's, reported in *Flight* of July 17th, 1909. In a lecture, he expressed the view that the immediate future of aeroplanes was, "for the time being at least, confined to the role of sport. For the purposes of war reliability was essential; they would have to be capable of going up in all weathers for spells of some hours, would have to be automatically stable and not dependent on the skill of the pilot, would have to carry two men, and be capable of landing safely on open ground. That stage of development had not been reached yet. Inventors should aim rather at increasing automatic stability than at increasing speed."

*DERNIER CRI: Recent improvements have been incorporated in XA557, a production Javelin FAW.1, here seen getting away smartly from the Gloster airfield at Moreton Valence. A Javelin will be demonstrated at the Paris Salon by test pilot "Geoff" Worral.*

## FROM ALL QUARTERS . . .

### Queen's Birthday Fly-past

ON the Sovereign's official birthday, June 9th, it is customary for a ceremonial fly-past to be staged by one of the operational commands of the Royal Air Force. This year the honour falls upon Coastal Command, who last performed the duty in 1952.

Eighteen Shackletons will accordingly fly over Buckingham Palace at 1 p.m., while Her Majesty takes the salute from the balcony. Three aircraft will be provided by each of six squadrons, which are as follows:

No. 120 (S/L. R. G. Ravenscroft), Aldergrove; No. 240 (S/L. A. T. Smallman) and No. 269 (S/L. J. Quinn), Ballykelly; No. 228 (S/L. K. McK. Murray); No. 206 (S/L. E. K. Paine) and No. 220 (S/L. C. B. Brown), St. Eval.

The Shackletons will be led by W/C. J. Dowling (O.C. Flying Wing, Ballykelly) and fly in two close arcs of nine aircraft. The leader of the second formation will be S/L. Murray. The aircraft will fly over Buckingham Palace at 1,000ft and there will be a 30-second interval between the two formations. Those from Ballykelly will rendezvous over St. Eval, and then set course for London. Their final approach route will take them over Clacton, Colchester, Fairlop and the City. After the fly-past over Buckingham Palace, the Shackletons will break away to the north-east and return to their respective bases.

### New Guinea Bases

NO fewer than 31 air bases have been constructed by the Dutch Government in the western part of New Guinea to combat infiltration from Indonesia and to develop new areas. The bases comprise 14 strips for landplanes and 17 bases for marine and amphibious aircraft, the latter being used by ex-Australian Canso and Catalina aircraft and also by more-recently-acquired Martin Mariners.

The Australian Prime Minister, Mr. Menzies, recently conferred with the Dutch Foreign Minister, Mr. Luns, and it is reported from Canberra that the two countries are co-operating in the defence of the New Guinea area. For 18 months Australia has permitted Dutch warships based in New Guinea to refuel at Manus Island, the Naval base north of Australian New Guinea. Vice Admiral de Booy, of the Royal Netherlands Navy, recently completed a tour of bases in western New Guinea, an area in which responsibility for defence has recently been transferred from the Dutch Army to the Navy. In emergency, it is reported that Holland would make the new bases available to Australia; it is known that she is anxious to join SEATO but would not do so if this meant estranging Indonesia.

To improve interior communications, a number of D.H.-Canada Beavers have been purchased, and a complete radio network, capable of being integrated with that of the Australian Department of Civil Aviation in East New Guinea, has also been constructed.

### Upper-air Rockets

CONSIDERATIONS of security and Government preoccupation with weapons have, in the past, been offered as the explanation of British scientists' lack of experience in the use of rockets for exploring the upper atmosphere. Now, however, and largely in connection with the International Geophysical Year, which opens in July 1957, the Ministry of Supply are to make available rocket-propelled vehicles with which aerological data will be telemetered back to the earth from heights of, in the first instance, 60,000ft (11.4 miles) and later 90,000ft (17.1 miles). The Geophysical Year is an international research project, directed towards cosmic-ray and other investigations, on an unprecedented scale.

### N.A.R. Third Round Entries

THE dates of the second and third rounds of the National Air Races fall very close together. The second round was decided at Yeadon on Whit-Monday and the third is at Whitchurch Airport, Bristol, on Saturday, June 11th. Entries for this third event have been announced by the Royal Aero Club, as follows:—

**S.B.A.C. Cup Class.**—G. Marler (Falcon Six), R. R. Paine (Hawk Speed Six), Mew Gull entered by F. Dunkerley, F. Dunkerley (Sparrowjet).

**Goodyear Trophy Class.**—P. Blamire (Gemini 1a), F. Dunkerley (Gemini 1a), J. N. Somers (Gemini 2).

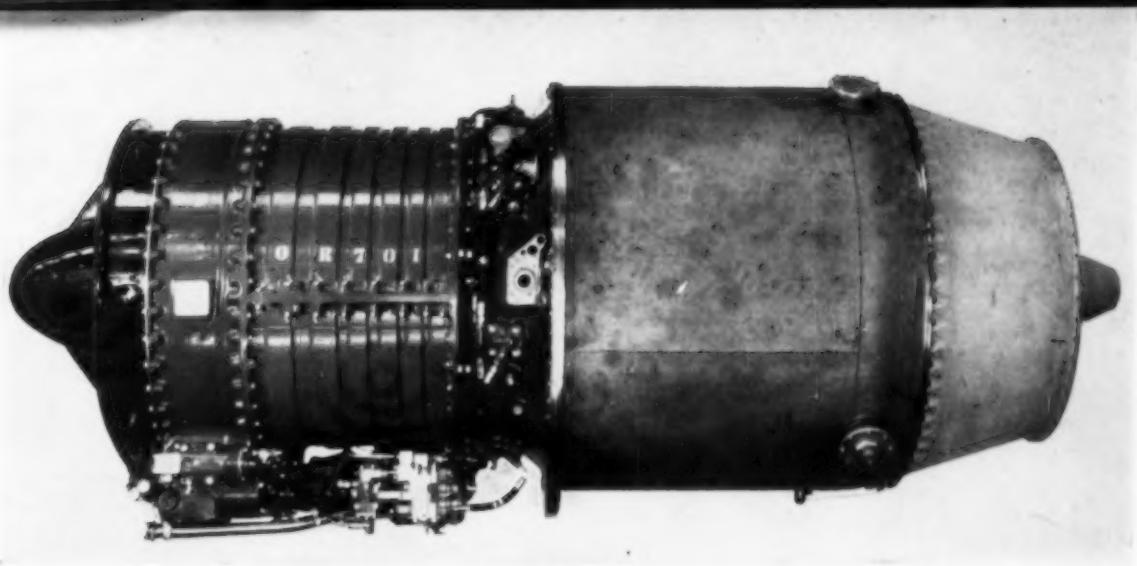
**Air League Cup Class.**—A. S. K. Paine (Proctor 1), E. Noel Husbands (Proctor 1), T. G. Knox (Proctor 3).

**Kemsley Trophy Class.**—A. J. Spiller (Messenger 2a), D. F. Ogilvy (Comper Swift), J. R. Johnston (Hawk Trainer 3), C. G. Wheatley (Globe Swift), J. N. Somers (Chipmunk), Capt. D. W. Phillips (Hawk Major).

**Norton-Griffiths Trophy Class** (For Tiger Moths).—B. Maile, P. Vanneck, J. H. Denyer, J. M. Donald, B. J. Snook, P. Q. Reiss, L. P. Griffith (1st reserve), H. Armitage (2nd reserve), J. A. Greenhead (3rd reserve).

**Grosvenor Cup Class.**—Miss F. M. Leaf (Tipsy Trainer 1), C. Gregory (Taylorcraft plus D), D. Westoby (Aiglet J.5K), J. E. Appleyard (Chilton D.W.1a), C. Cruikshank (Taylorcraft Plus D).

*IN THE TORTURE CHAMBER: Sir Miles Thomas, chairman of B.O.A.C., and Dr. P. B. Walker, head of the Structures Department of the R.A.E., see the Bristol Britannia "specimen" ready for its test in the 300,000-gallon pressure-tank at Farnborough. The sample, virtually a complete airframe but for the tail unit, will undergo the equivalent of some 20,000 flying hours. The complete pressurization cycle is applied, every three minutes, to the hull, and representative loads are imposed simultaneously on the wings.*



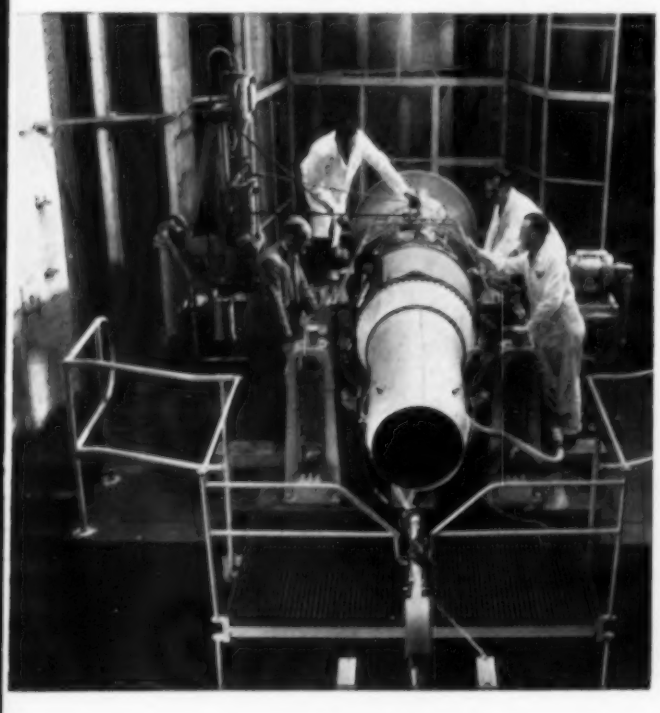
# BRISTOL ORPHEUS

## *A Medium-thrust Turbojet with Exceptional Potentialities*

LAST week the Bristol Aeroplane Company announced that an Orpheus turbojet had successfully completed a Ministry of Supply 150-hour Type Test. Co-incident with this excellent news has come permission to publish photographs of this engine, and two are reproduced here. No description may yet be given, although certain salient features can be deduced from the appearance of the engine.

With the company designation B.E.26, the Orpheus was planned late in 1953 to meet an anticipated demand for a modern turbojet in the 3,000 to 5,000 lb-thrust class. The predominant factors governing the design were performance, simplicity, reliability, ease of maintenance and light weight. It can therefore be inferred that the Orpheus is not a two-spooler, but a single-shaft engine—and the photograph above shows it to be a remarkably compact unit.

At the front is a simple intake casting, with a central bullet fairing. Next comes the compressor, which is obviously an axial with less than eight stages; the casing is amazingly short and is split into top and bottom halves. A diffuser casting follows, around which can be seen flexible fuel hoses, there being two hoses leading to each burner. The main bulk of the engine seems to consist of the combustion chamber, which is covered by a smooth welded casing. There are protuberances around the rear part of this casing, covered by bolted caps; the turbine should lie in this region, and the tailpipe cone is attached by a peripheral row of bolts. The small conical inner cone can just be seen projecting on the extreme right.



Accessories are situated under the fore-part of the engine, probably driven by a shaft in the "six o'clock" intake strut fairing. The engine intake ring carries a peripheral flexible seal which no doubt abuts with the aircraft ducting. A main mounting trunnion is placed near the engine centre of gravity on each side.

The small number of compressor stages should not necessarily be taken as indicative of a low pressure-ratio or poor efficiency. In recent years much has been learnt about axial compressors, and current values of work-per-stage are more than twice those achieved with early engines. Again, a fair amount of help can be gained from ram compression, particularly in supersonic aircraft. Probably, therefore, the Bristol designers have been able to use a very simple rotating assembly, with a short compressor driven by a single turbine stage, the whole being carried in two bearings. It was revealed earlier this year that the low-pressure compressor of the B.E.25 turboprop is aerodynamically identical with the Orpheus compressor, but employs steel, instead of aluminium, blading.

Bristols stress the low cost of the Orpheus, which is attributed to "concentration on weight saving and simplicity . . . without recourse to unconventional methods." It is stated that "the engine embodies those design features which experience has shown to reflect regular periods between overhauls." The company state that the unit can be completely stripped in a few hours.

Development of the Orpheus has been so rapid as to set wholly new standards. The first engine ran on December 17th, 1954. Since that date, over 1,500 hours has been logged, and five Orpheus are at present available. Last week, the first flight engine was set up for running, and it will then be delivered to Follands for installation in the prototype Gnat, scheduled to fly in the summer. Other aircraft to receive Orpheus power are the Fiat G.91, Dassault Mystère 26 and Bréguet 1001 Taon.

The thrust achieved during the type test was 3,285 lb; higher powers have since been attained, and intensive development is proceeding. It is pointed out by Bristols that, even on the basis of this early rating, the Orpheus is more powerful—weight for weight—than any other 150-hr type-tested engine in the world; the figure is 4.4 lb-thrust per lb-weight. The dry weight is thus calculated to be some 746 lb. The power : weight ratio, already outstanding, may be expected to reach even more competitive levels later on. (It has also been unofficially reported that a simplified form of afterburning is being developed for the Orpheus.)

There seems no doubt whatever that the Orpheus, initiated as a private venture, will prove to be the only engine capable of filling some of the most important requirements of the next few years. Every aspect of the Orpheus emphasizes that it is, as we described it recently, "the Golden Boy of the Bristol Gods."

***Dimensions of the Orpheus may not yet be given, but the development engine seen on its test-bed at Filton may be matched for scale against the Bristol engine division personnel looking at it. At the head of the page is a direct side-view, from which overall Orpheus proportions may be gathered. The neatness and simplicity are outstanding.***

*PILOTLESS: Stored in underground magazines (left), Douglas Nike guided missiles are being acquired, at $25,000 apiece, for the protection of all major American cities and centres. The Aviolanda AT-21 target, seen in model form above, is referred to on page 759.*

# HERE AND THERE

### R.A.F.A.'s Royal Chairman

WHEN the Royal Air Forces Association holds its annual conference at Eastbourne this week-end, H.R.H. the Duke of Edinburgh will take the chair as the Association's president. He is to arrive at Eastbourne by helicopter, landing on the Western Lawns at noon on Saturday. On Sunday morning he will attend a memorial Service and afterwards take the salute at a march-past. Delegates from all parts of the world will attend the conference, at which more than 700 R.A.F.A. branches will be represented.

### The Caravelle Flies

PILOTED by Pierre Nadot, the S.E.210 Caravelle twin-Avon transport, subject of a very detailed description in *Flight* of May 20th and 27th, was initially flown from Toulouse on May 28th. It is reported to have made two circuits of the airport in the course of a trouble-free 22 minutes in the air.

### Dr. Newman Leaves A.W.A.

ON Friday last Sir W. G. Armstrong Whitworth Aircraft, Ltd., announced that Dr. L. W. J. Newman, B.Sc., Ph.D., A.F.R.Ae.S., is relinquishing his position as chief engineer of their armaments division. He leaves, they add, with the best wishes of the Company and of all his colleagues.

### Getting Down to It

TALKED OF for many years past, now on an official level, a Southern Region spur to London Airport Central is still many years from realization. Meanwhile, Sabena Airlines and the Belgian Railways have started an underground "autorail" service—half-hourly, non-stop—between their Brussels city terminal and Melsbroek. It was inaugurated on May 16th by King Baudouin. Sabena already have an S-55 helicopter link between city and airport.

### Adaptability

AN AUSTRALIAN correspondent tells of a recent incident in the far north of Queensland which typifies the work of the Royal Flying Doctor Service. An Auster ambulance aircraft was called to fly 60 miles north from Cairns to a sick man's home in the remote pioneering settlement of Bailey's Creek. There is nothing resembling an air strip at the Creek, so the pilot timed his arrival for low tide and put down on the narrow strip of beach near the settlement; the ambulance bearers had to walk only a few yards to the patient's home.

### History to Repeat Itself

IT is reported from Ottawa that a full-scale reproduction of a Blériot monoplane is to be used in an attempt to re-enact the channel flight on July 25th, the 46th anniversary of the pioneer pilot's achievement. This machine, presumably, is the Blériot XI built by Mr. S. N. Green, of Calgary, Alberta, mentioned in *Flight* last year.

### Classic Motor Cycle Races

THE famous T.T. motor cycle races are about to take place in the Isle of Man—the Clubmen's race tomorrow, June 4th, the Junior T.T. on Monday, the sidecar, 250 c.c. and 125 c.c. events on Wednesday, and the Senior T.T. on Friday. Fully illustrated reports of these events will appear in the *Motor Cycle Tourist Trophy Number* of June 9th (for the first two events) and the *T.T. Report Number* on June 16th.

### Friendship Amendments

SINCE the description of the Fokker F.27 Friendship on pages 762-767 closed for press, the Fokker company have stated that the static and fatigue tests will now be performed on the second and fourth airframes respectively (and not *vice versa*, as stated in the article). The company have also disclosed details of their revised anti-icing installation: this will feature Delaney Gallay heat-exchangers for thermal anti-icing of the wing leading-edge, and Napier electrical de-icing for the tailplane. As mentioned in the article, this scheme has been designed to meet the more stringent C.A.A. de-icing requirements recently proposed.

*HAMBLE-BOUND: The first flight engine in the new Bristol series, now ready for delivery to Folland Aircraft for installation in the prototype Gnat. This photograph gives a good idea of the size of the compact new unit. More Orpheus news appears on the previous page.*

# AS IT WAS . . .

**BRISTOL BULLDOGS** armed many of the R.A.F.'s first-line fighter squadrons in the late twenties and early thirties, and were also supplied to the air forces of six other nations. The Bulldog, with its Jupiter engine, had the distinction of being the first of many famous aircraft of which both the airframe and power-plant were of Bristol design to go into large-scale production. Today the most significant all-Bristol product is the Proteus turboprop-engined Britannia airliner.

*This phenomenal progress in design and development is matched by the parallel success of Esso's research and development on fuels and lubricants capable of withstanding the increased speeds and altitudes of supersonic flying. The products of Esso's research, and the Company's vast resources and technical experience are at the service of all who have fuel and lubricant problems on aircraft of the present and of the future.*

*It pays to consult*

Esso

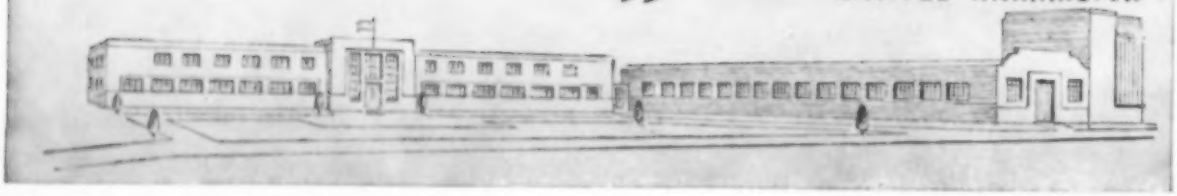
**ON ALL FUEL AND LUBRICATING PROBLEMS**

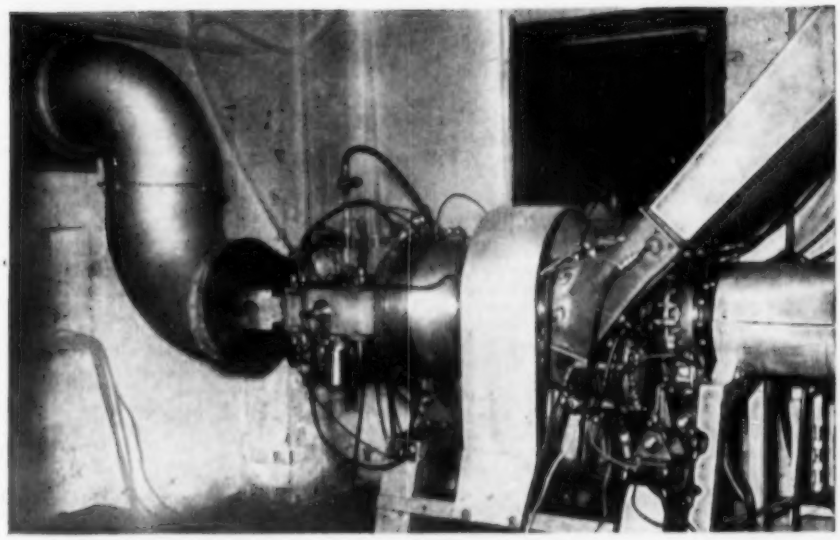
ESSO PETROLEUM COMPANY LIMITED, 36 QUEEN ANNE'S GATE, LONDON, S.W.1. *AVIATION TECHNICAL SERVICE, RELIANCE 1261*

# RESEARCH

Source photograph by The Times "REVIEW OF INDUSTRY"

ELECTRO-HYDRAULICS LIMITED WARRINGTON





*A Blackburn-Turboméca Turmo 600 undergoing endurance testing. The output gearbox is partially hidden by the sloping exhaust duct, and the dynamometer brake is off to the right (see drawing on p. 756).*

# BLACKBURN-TURBOMECA

## *An Outstanding Range of Small Gas Turbines*

AFTER World War 2, Blackburn and General Aircraft, Ltd., decided that their ultimate aim must be to enter the field of gas turbine manufacture. Previously the company had established a world-wide reputation for small piston engines, having in 1934 taken over the business of Cirrus Engines, Ltd., the first unit of whose family had run in 1925.

Owing to Blackburn concentration upon small piston engines it was natural to turn to the consideration of small gas turbines. By about 1950 the designs of M. Szydlowski, president of the Société Turboméca, of Bordes, France, were attracting considerable attention, and it was quite evident that they were more fully developed than any other engines of their class anywhere in the world. The British company eventually decided to purchase a licence for the development, manufacture and sale of all units of the Turboméca range; the years of toil and trouble which must precede the introduction of any wholly new gas turbine were thus largely circumnavigated and, at a guess, Blackburns may have saved at least three years by adopting an existing product.

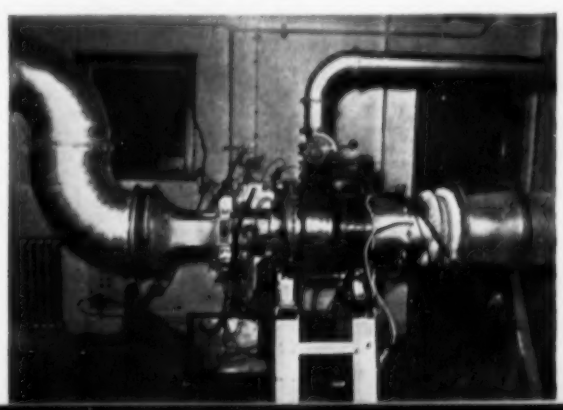
The initial liaison with the Turboméca company was the responsibility of G/C. H. J. ("Willie") Wilson, C.B.E., A.F.C., manager of the engine division, who joined the Yorkshire company as sales manager (engines). By September, 1952, a Palouste air-compressor engine had been shipped to the Blackburn works at Brough, East Yorks, and the actual licence was signed the following month. The Palouste was running, in a former piston-engine cell, in November, 1952.

The acceptance of a basic French design was, however, only the beginning of the British company's work. The original Turboméca gas turbines comprised units intended to produce propulsive thrust, shaft-power or compressed air. All the earliest French engines were turbojets, and these—alone of the range—were almost "bread-and-butter" articles by the time Blackburn bought their licence. But any need for small turbojets in Britain already promised to be met adequately by axial engines such as the Armstrong Siddeley Viper and Rolls-Royce Soar; for this reason, and on other grounds, it appeared to Blackburns that the overall future for Turboméca turbojets was likely to be less extensive than that for shaft-drive engines and air compressors.

This implied a considerable amount of work before production could start, and the company accordingly decided to establish a first-class design staff capable of extracting the utmost from the obviously sound basic French conception. As chief designer (engines) Mr. F. R. Bell was secured; he had previously been in charge of research on the Rover gas-turbine car, and before that had specialized on axial compressors with Rolls-Royce. His assistant is Mr. W. B. Mathison; in charge of the development of Blackburn-Turboméca gas turbines, he was formerly a Cirrus Engine Division man and a product of the company's apprenticeship scheme. These two engineers formed the core of the team which is now at full pressure on gas-turbine development.

By mid-1953 Blackburns were able to start a comprehensive programme of redesign, not only to "Anglicize" the engines but to effect a number of significant improvements. Initially, of course, everything had to be converted to British dimensions, standards, tolerances and fits. Material specifications had to be selected, drawings prepared, Unified threads adopted and a comprehensive range of material suppliers and sub-contractors established. At the same time, detail redesign was undertaken along two main lines. First, the Blackburn engines had to meet Ministry

*(Left) A Palouste stripped on the bench. In the foreground are a combustion chamber casing and air-bleed volute; on the right-hand side of the bench are the diffuser and combustion chamber liner, and the engineers are examining the rotating assembly and intake casting. (Right) A Blackburn-Turboméca Palouste 500 on test at Brough. The intake is on the left, the exhaust on the right and the air-bleed pipe leaves from the centre.*



## BLACKBURN-TURBOMÉCA . . .

of Supply requirements for reliability, safety and accessibility which did not apply to the French units. Second, one of the units which seemed to have a particularly wide field of applications —the Turmo free-turbine shaft-drive engine—had originally been designed to power an armoured fighting vehicle, and its detail design had been done without paying particular attention to the weight (it was illustrated in this form on page 159 of our issue of February 5th, 1954). Accordingly, Blackburns examined the whole engine, and effected considerable redesign to improve it for aircraft use. In particular, considerable weight reductions were made in the main casings and reduction gear.

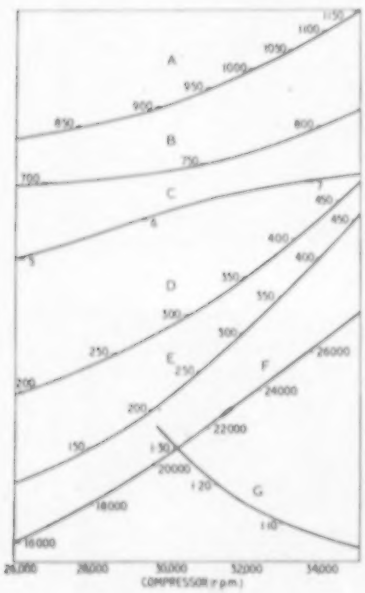
While this was being done, action was taken to redesign the accessory arrangement at the front end of all the Turboméca engines, since it was clear that considerable revision of this nature would have to precede the introduction of Blackburn-built engines into operational service. The original French units employed a simple air entry direct to the eye of the centrifugal compressor (except for the shaft-drive Artouste, in which air was induced through a down-take behind the reduction gearbox). No provision was made for accessories, apart from a starter—of the air-jet or electric variety—and tachometer drive. For British use, the incorporation of a comprehensive range of accessories was a *sine qua non*; such accessories, moreover, had to be capable of arrangement to suit the needs of various installations while retaining a high degree of accessibility.

The outcome was a wholly new front end. The intake casting was made much longer, and the ducting was bifurcated right up to the point of entry to the compressor. Between the ducts was carried a shaft extension to the compressor/turbine assembly, driving two lateral trains of spur gears at the extreme front of the engine, there being one train of three gears above the intakes and a similar train below. Each gear was so mounted that it could drive an accessory mounted either in front of or behind the cast gear-housing; thus, the four outer positions provided for eight possible accessory positions, while the gears above and below the centre-line offered four possible situations for the fuel and oil pumps. This revised front end was the first complete redesign undertaken by Blackburns, and it has amply proved its worth. In aircraft installations it is naturally desirable to mount accessories on the rearward-facing pads in order to save length (see sketch). All accessories lie within the diameter of the engine.

When it first appeared in public, at the 1954 S.B.A.C. show, this intake system received criticism from several gas-turbine engineers who were convinced that its efficiency would be very low. The Brough company has established that the performance of the engines has in no way been adversely affected and that the intake works well under all conditions. Its performance was further improved recently by the addition of a "droop-snooted" splitter panel in each duct, to improve flow around the inner wall as it curves around to the entry to the impeller.

As previously mentioned, it is possible to modify the basic turbojet by the addition of a collector duct for the extraction of compressed air (supply of the latter being, in this case, the sole purpose of the engine). Such an engine must, however, incorporate internal modifications, for the mass flow through the compressor is greater than that through the turbine, the difference being equal to the amount tapped off for external consumption. In the Palouste, a standard-size compressor was matched with a turbine of reduced capacity, and — in order to extract sufficient shaft power from the reduced airflow — a second turbine stage was added downstream of the original stage.

This two-stage turbine has characteristics associated with a full-pressure flow only about two-thirds as great as that for which the original turbine was designed. From this reduced-capacity turbine has been evolved a complete range of Blackburn-Turboméca gas turbines identical with the basic range except for detail redesign to operate with a mass flow reduced by about 35 per cent. The actual modifications at present comprise no more than slight alteration to the geometry of the compressor rotating guide vanes, to the throat area of the diffuser section to reduce the throughput, use of the smaller turbine and other very slight changes.




***Performance curves for a Turmo 600 (provisional, at sea level, in I.C.A.N. conditions).*** A, compressor-turbine inlet temperature deg K; B, jet-pipe temperature deg K; C, air mass flow lb/sec; D, fuel flow lb/hr; E, s.h.p. at optimum power-turbine r.p.m.; F, optimum power-turbine r.p.m.; G, specific fuel consumption in lb/hr/s.h.p.

The reduced-flow engines are designated by the suffix "500" after the name of the engine, the standard units bearing the suffix "600."* The effect of reducing the throughput is to reduce the overall losses throughout the engine and slightly to increase the efficiencies of the compressor and combustion system. As a result the specific fuel consumptions of the 500-series engines are significantly better, although the specific weights are naturally higher. It follows that the reduced-flow engines will be more attractive in the industrial, marine and automotive fields, whereas for aircraft applications the 600-series units will, on balance, be preferred.

The Blackburn and General Aircraft Company have, therefore, established a comprehensive range of small gas turbines tailored to the requirements of a very wide range of applications. When studying the range as a whole it is of paramount importance to note that component-interchangeability between one type of engine and another has been carried to the limit.

The basic engine is the Palas 600 turbojet, comprising accessory section and intakes, compressor, combustion system, turbine and propelling nozzle. By replacing the propelling nozzle by an extra turbine stage, mechanically independent of the rest of the engine, driving a reduction gearbox, the Turmo free-turbine engine can be formed. Alternatively, by having two turbines stages on the same shaft as the compressor, and carrying the shaft-power forwards to a similar reduction gearbox mounted on the front of the engine, the single-shaft Artouste can be obtained. Yet again, starting from the Palas simple jet, the Palouste air compressor can be fabricated by the alterations already described. It is not very likely that many purchasers would ever actually wish to turn one type of engine into another of the range, but the possibilities inherent in the standardization of basic parts are enormous. Both in the manufacture and maintenance of Blackburn-Turboméca engines it has permitted financial savings to be made, reduced the need for a large inventory, cut down on tooling, saved time and increased the flexibility of the range as a whole.

The remainder of this account is devoted principally to a description and analysis of each of the Brough-developed engines, together with notes upon the present state reached by each unit.

**Palas.** As the basic turbojet from which the other engines have evolved it is appropriate to discuss this unit first, although it is by no means the most important Blackburn-Turboméca engine at present. It is employed, in the succeeding paragraphs, as a basis upon which to write a broad description of the salient features of the Blackburn-Turboméca gas-producing section.

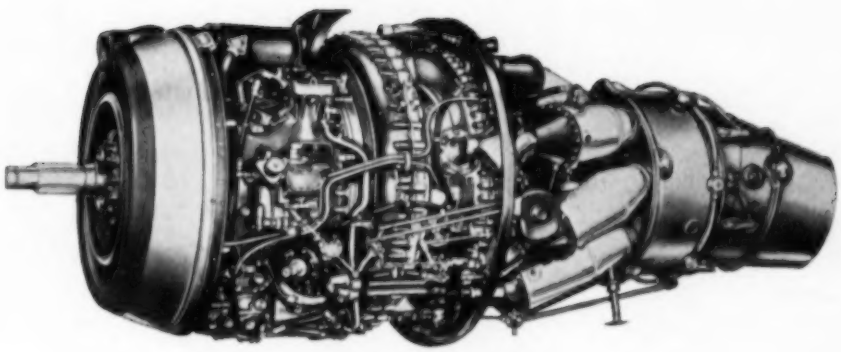
Starting at the front, the main intake casing is a casting in L.51 light alloy. The largest single part of any Blackburn-Turboméca engine, this casting includes the radial front face of the compressor casing and the axial cover over the compressor diffuser section. The latter portions are finished on a vertical borer, the intake interior being hand-fettled. It incorporates a pair of oil tanks, one outboard of each intake trunk, and an oil-level window is provided in the outer wall of each tank. The tanks are connected by a gallery, so that both can be filled from either side.

Around the circular periphery at the rear of this portion is a row of through-bolts, which attach the casting to the casing over the combustion chamber. This casing, which is fabricated from D.T.D. 171B stainless steel, forms the backbone of the engine and is, in turn, bolted to the ring-sections around the turbine. The latter are pressed from heavy-gauge stainless-steel sheet.

The combustion system was undoubtedly the most outstanding of the original conceptions of M. Szydlowski, and it differs markedly from that of any other gas turbine. As can be seen from the large drawing (the Turmo combustion system is the same as that for any other engine in the range) air from the compressor can take any of several paths upon entering the combustion chamber. Some passes through holes in the chamber liner; some flows over the forward face of the liner to cool the latter before being drawn off elsewhere; some enters the combustion zone *via* short tubes welded to the liner which impart to the air a strong radial inward flow; and the remainder passes around the chamber and flows inwards through the hollow turbine inlet guide vanes, from which it reaches the interior of a mushroom-like unit which surrounds the axis of the engine. The last flow of air escapes from perforations over the front face of the mushroom and becomes primary air supporting combustion.

Fuel enters the engine along the hollow accessory-drive shaft. It then passes down the axis of the rotating shaft and compressor,

**Each basic type of Blackburn-Turboméca engine has a name (such as Turmo), different forms of the same engine being distinguished by a different range of "hundreds." Series 500 and 600 are the middle figures of a range which may finally cover all powers between 100 and 1,000 h.p.*



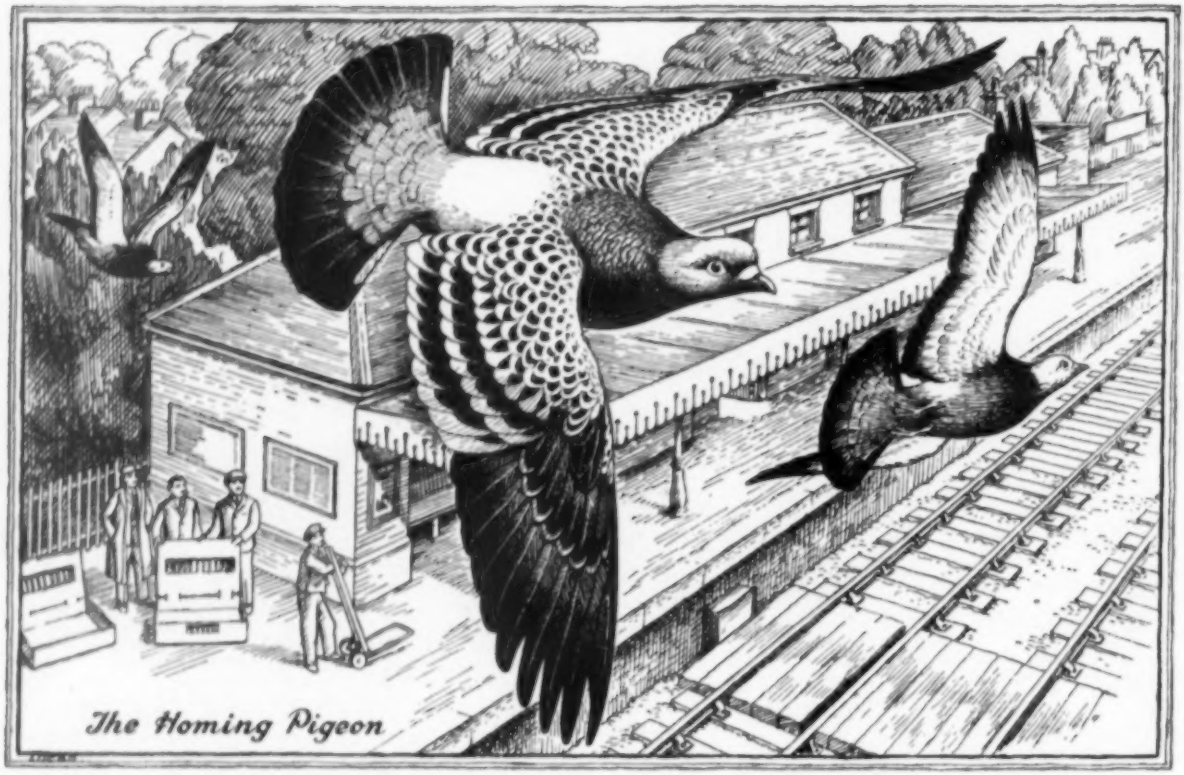
The

# ROLLS-ROYCE DART

the only propeller turbine
aero engine in service in the world
powers the
FOKKER FRIENDSHIP

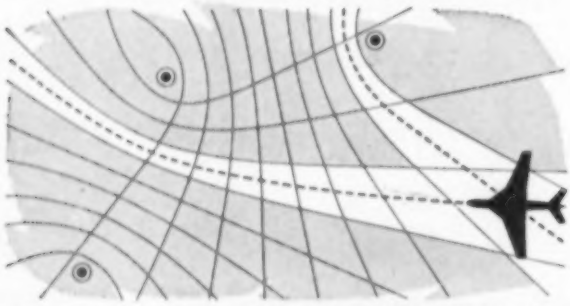
ROLLS-ROYCE LIMITED · DERBY · ENGLAND

*Problems of flight*




# ON THE BEAM

**By flying down a beam pilots can come into an airfield they cannot see and could not possibly find. With this invaluable technique man has rediscovered a gift he may once—long ago—have had : one that many creatures have in highly developed, highly efficient form.**



**Butterflies cross seas and make safe landfalls; the Chinook salmon swims oceans and returns, infallibly, to the very pool of the very river in which he was born ; a pair of finches divide their year, season after season, in a particular bush in an English garden and another in a North African orchard. Most astonishing of all, the homing pigeon can be taken in any direction, for any distance, and after a turn or two in the air will fly unhesitatingly straight for home.**

**How does the pigeon do it ? We do not know. We may never know. It is not sight, nor smell. If it is sense of direction, this must be developed to a degree of sensitive infallibility which puts it clear beyond human understanding. We can only say that —like hundreds of kinds of migratory creatures— the pigeon feels some mysterious, unmistakable pull towards home : that he senses some "radio beam" that gives him his direction.**

**Though we may never know the mechanics of the homing pigeon's "beam", we imitate its effects. Landing under any but the best daylight conditions can be difficult indeed without this navigational aid we have copied from Nature.**

**Pilots who come in to land on a beam or off it, have come to value, at all Britain's major airfields, the excellent and helpful service of the Shell and BP Aviation Service.**

## SHELL and BP AVIATION SERVICE

*Shell-Mex and B.P. Ltd., Shell-Mex House, Strand, London, W.C.2.*
*Distributors in the United Kingdom for the Shell, B.P. and Eagle Groups.*

## BLACKBURN-TURBOMÉCA . . .

enters an assembly inside the large-diameter compressor-drive shaft and finally escapes through fine holes drilled around the latter. It is, in fact, flung from the latter by centrifugal force, and enters the combustion space in a finely atomized condition with both a tangential and radial motion. Combustion takes place with scarcely any axial movement, and the outward-flowing primary flame (which, it may be noted, is truly annular, and so differs from that in any other gas turbine yet flown) is cooled, diluted and turned back to the rear by the air flowing through the holes and tubes around the chamber liner. The products of combustion leave the chamber between the turbine inlet guide vanes, which are cooled by the primary air flowing through them. The latter air is therefore turned through 360 deg between leaving the axial diffuser and entering the turbine.

In all British-made engines, the combustion system is fabricated from Nimonic 75 sheet, welded to close tolerances in the usual manner. The principal suppliers at present are Briggs Motor Bodies and Joseph Sankey, both of whom manufacture complete assemblies. The British combustion system is reckoned to have a rather better life than that of the original French assembly, largely owing to the use of the Nimonic sheet. Any normal distillate fuel can be employed, as noted later in the paragraph on the fuel and control system.

As already stated, the turbine inlet guide vanes, or stator blades, are of hollow fabricated construction. The material is again Nimonic 75, Argon-arc-welded into pressed rings.

The centrifugal compressor is a forging in D.T.D. 731 light alloy. It is profiled in a conventional manner, to incorporate 16 radial vanes, the air passages being polished. In the French engines the whole compressor was of light alloy, but experience has led to the use of steel for the curved rotating guide vanes, or inducer vanes. These vanes are now profiled from a single piece of H-T steel by a cutter controlled by a master blade and pantograph. The complete impeller, with the steel vanes added, weighs 9 lb and has a diameter of 10-12in.

The hollow compressor/turbine shaft is a steel forging machined to a wall thickness of 0.2in. It has overall dimensions of roughly 15in length and 3.6in outside diameter, and it is finished to close tolerances. The compressor is shrunk on at the forward end of the shaft, and the turbine is attached by a flange and ½in bolts (⅜in bolts were originally used, but the higher operating temperature which can be employed in the British engines—discussed below—caused out-of-balance forces with this bolt size). The rationalization of design carried out at Brough has also greatly reduced the number of parts in the main rotating assembly.

Blackburn-Turboméca engines make use of a wider range of high-temperature materials than are at present available in France. In particular, it was decided early in the redesign of the British units to employ Nimonic 90 as the turbine material, and so raise the operating temperature limits by some 80 deg C. This has, in fact, been done, although some of the Brough-built turbines are otherwise facsimiles of the corresponding French units.

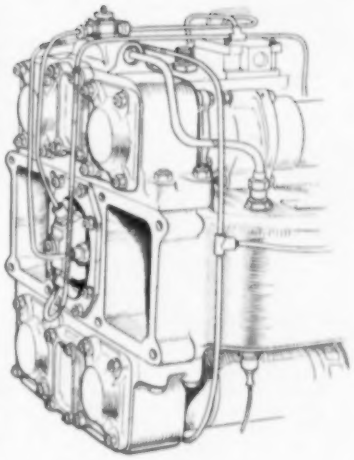
The turbine is made entirely from one disc of Nimonic 90, the blading being cut from the periphery. The forged disc is first turned and faced, using a neat cutting oil with added molybdenum disulphide, and is then transferred to a horizontal miller where it is trepanned using barrel-type cutters. The work-piece is then profile milled in a universal miller, using an aluminium master representing a 120-deg segment of the finished turbine. The cutters, which contain 5 per cent cobalt, are treated with moly-disulphide stoved-on, and neat cutting oil is used. The finished turbine is then dressed, after o.d. grinding and jig-boring of the holes for the drive bolts.

The whole rotating assembly is carried in two bearings, a ball thrust bearing at the front and a plain roller bearing at the rear. The latter is carried in a cast-Meehanite bearing housing, held by three radial struts spaced at 120-deg intervals, these struts being steel tubes faired by Nimonic sheet wrapped to an approximately aerofoil section. Originally these strut fairings were somewhat fat, and it was decided to reduce their thickness/chord ratio by increasing their chord—and, therefore, the overall length of the engine—by four inches. This has now become standard on all Blackburn-Turboméca engines, and it provides a slight improvement in performance, for a weight penalty of some 8 lb.

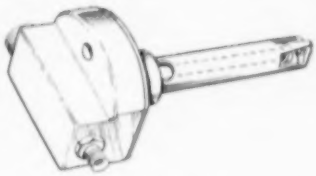
**PRINCIPAL BLACKBURN-TURBOMÉCA ENGINES 1955**

| | Max. Output | | Dry wght. (lb) | Overall dimensions | | |
|---|---|---|---|---|---|---|
| | Free Air | Fuel (lb/hr) | | Length | Width | Height |
| | 2.725 lb/sec 57.25 lb/sq in | | | in | in | in |
| Palouste 500 | Max. h.p. | 310 s.f.c.(lb/hr/h.p.) | 178 | 28.62 | 17.7 | 18.6 |
| Turmo 600 | 450 | 1.04 | 281 | 46.12 | 17.1 | 21.0 |
| Artouste 600 | 475 | 0.99 | 278 | 40.0 | 19.25 | 18.55 |

Notes: All the above engines have a compressor mass flow and pressure ratio of, respectively, 7.19 lb/sec. and 4.12:1. All the shaft-turbine figures (Turmo and Artouste) assume the use of a two-stage reduction gear.



*A typical Blackburn-Turboméca front-end (Palouste or Turmo). Air, oil and fuel enter at the centre, between the intake ducts. All six forward-facing drive-pads are blanked off in this particular engine, the accessories being mounted on the rear faces.*



*The neat torch igniter consists of a fuel-, electricity- and temperature-proof plastic block, out of which extends a fuel jet surrounded by a pipe for induced air. Fuel is atomized against a target at the end, and a high-energy spark jumps the gap between the fuel-line and outer air tube.*

Immediately behind the compressor impeller is the compressor back-plate, machined from a single cast light-alloy disc. The rough disc has a periphery which is profiled into a series of radial aerofoil sections which form the axial part of the diffuser section. The radial diffuser is a copper-brazed stainless-steel assembly. The hub of the back-plate incorporates a labyrinth seal, of which there are a total of four in the Palas and more in other units of the range.

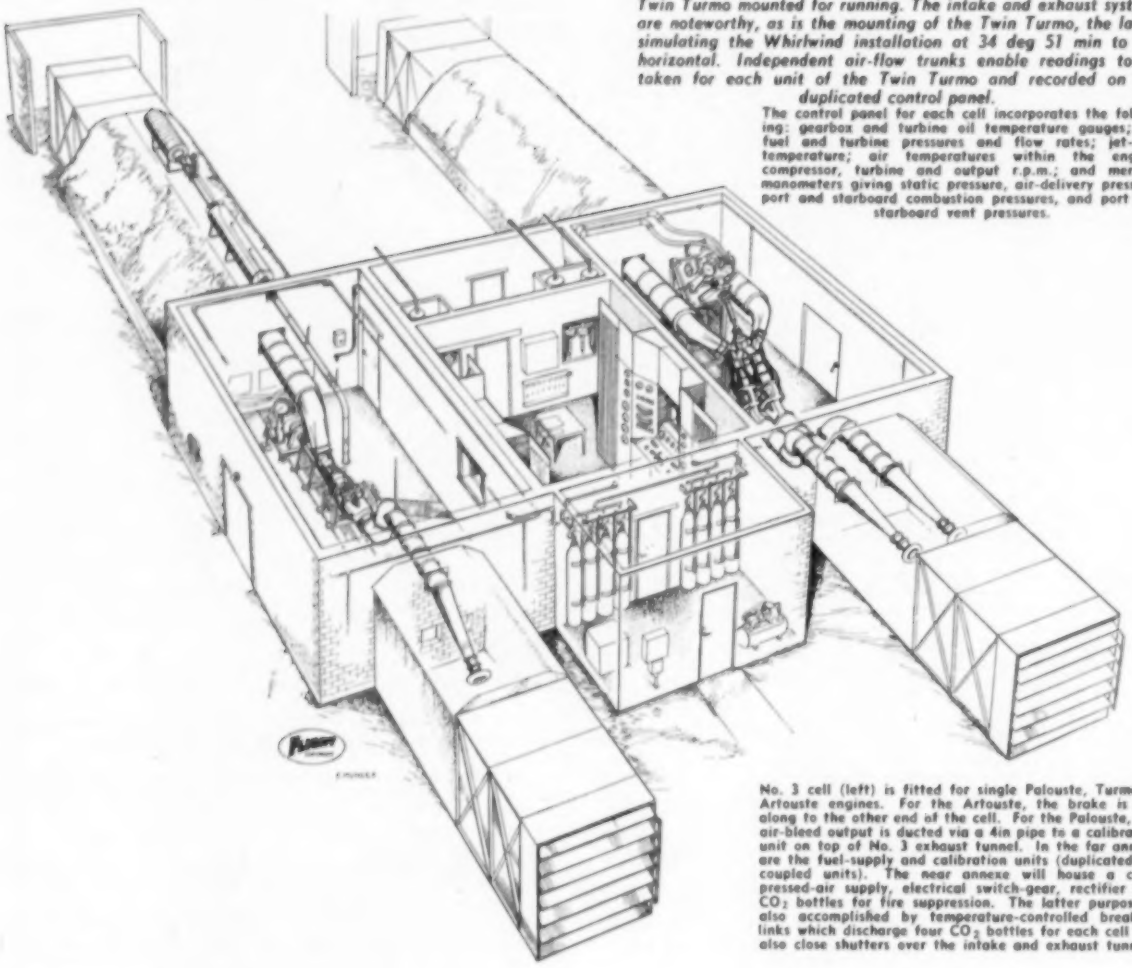
As already described, there are no fuel burners in the accepted sense, fuel being sprayed from the hollow compressor shaft by centrifugal force. The flame does not, of course, touch the shaft; sustained combustion starts at a radial distance of about one inch. Fuel is fed to the central shaft by a Plessey single-stage gear pump, the output from which is governed by a Lucas control unit. The latter, which is simple and rugged enough to be used on Blackburn-Turboméca industrial units, can embody a quartz-rod sensing unit which restricts the maximum jet-pipe temperature to below 700 deg C in tropical conditions—or, in shaft-driving engines, when running under heavy load, to 650 deg C.

Throughout the running range the engine is controlled by a single power lever, the acceleration fuel flow being trimmed by an adjustable bleed to prevent the compressor from surging. A governor maintains the idling speed at about 10,000 r.p.m. and also controls the engine at the top end of the speed range.

The Palas, and other units of the Blackburn-Turboméca family, can be started either electrically (requiring about 200 amp at 12 or 24 V, for a duration of 30 sec maximum) or through a hand-turning gear. If the latter is employed, the gear ratio is usually 1 : 80 and either one or two handles can be used. With hand-turning gear, the ignition can be effected by a magneto-type spark unit, thus dispensing with the need for batteries. Normally, however, a high-frequency high-energy spark is obtained from a unit taking about 5 amp. This spark lights up a torch igniter, which receives the initial delivery of fuel from the control system, and the starting system automatically cuts out just before idling speed is reached.

The fuel and control system of all present engines of the range can be employed, without modification, for any distillate fuel, and operates up to an altitude of 10,000ft. Where the installation requires it, extra equipment can be added to increase the permissible altitude range.

Lubricating oil, not necessarily of the high-temperature synthetic variety, is drawn from the two integrally cast tanks and circulated by a compact three-chamber gear pump. Of the three chambers, two are employed to scavenge oil from either end of the engine while the third feeds pressure oil to the main bearings and accessory gearbox. Filters and strainers are incorporated in the oil system, but no separate cooler is required. The warm oil in the tanks assists in keeping the intake trunks free from ice.



*The new twin test house at Brough, showing a Turmo (left) and a Twin Turmo mounted for running. The intake and exhaust systems are noteworthy, as is the mounting of the Twin Turmo, the latter simulating the Whirlwind installation at 34 deg 51 min to the horizontal. Independent air-flow trunks enable readings to be taken for each unit of the Twin Turmo and recorded on the duplicated control panel.*

The control panel for each cell incorporates the following: gearbox and turbine oil temperature gauges; oil, fuel and turbine pressures and flow rates; jet-pipe temperature; air temperatures within the engine; compressor, turbine and output r.p.m.; and mercury manometers giving static pressure, air-delivery pressure, port and starboard combustion pressures, and port and starboard vent pressures.

No. 3 cell (left) is fitted for single Palouste, Turmo or Artouste engines. For the Artouste, the brake is run along to the other end of the cell. For the Palouste, the air-bleed output is ducted via a 4in pipe to a calibration unit on top of No. 3 exhaust tunnel. In the far annexe are the fuel-supply and calibration units (duplicated for coupled units). The near annexe will house a compressed-air supply, electrical switch-gear, rectifier and $CO_2$ bottles for fire suppression. The latter purpose is also accomplished by temperature-controlled breaking links which discharge four $CO_2$ bottles for each cell and also close shutters over the intake and exhaust tunnels.

## BLACKBURN-TURBOMÉCA . . .

Accessories naturally depend upon the installation, but any Blackburn-Turboméca unit can carry four main units, such as a main and standby D.C. generator, a tachometer and a starter motor. To save space axially, these would normally be mounted on the rear face of the drive boxes, and additional units could then be accommodated on the front of the engine (as has, in fact, been done with the Palouste). Originally all accessories were bolted on, but ease of removal and replacement of all such units has now been greatly improved by adopting ring clamps. These are circumferential straps with a profile matching with tapered flanges on both the drive box and the appropriate accessory so that, when tightened by a tangential turnbuckle, the strap brings the accessory hard up to its mounting face.

The above features are common to all units in the Blackburn-Turboméca range, and are therefore not mentioned in the succeeding paragraphs. As for the Palas itself, there is at present no requirement for this small turbojet except for one-off installations, such as the Somers-Kendall SK-1 racer. Mention should also be made of the Turboméca Marboré, an 800-1,000 lb-thrust turbojet which is covered by the Blackburn licence agreement but which is not found at Brough at all, as it is larger than any of the standard units in the Yorkshire firm's rationalized range. As the J69, however, the Marboré is the most important engine of Turboméca's other licensee—Continental Motors Corporation, of Michigan.

**Palouste.** The sole purpose of this engine is to supply compressed air, the normal maximum delivery being about 2.5 lb/sec at a gauge pressure of about 42 lb/sq in. Compared with the basic Palas, the Palouste has an identical compressor handling air at the same rate; the P, air is, however, divided in the ratio 2.5 : 4.7, so that for every 100 lb of air delivered by the compressor about 65 lb is passed through the combustion system and turbines and 35 lb extracted for some other purpose (such as providing air for the tip-drive of a helicopter rotor).

As already noted, the standard Palouste is the Palouste 500, in which a full-capacity 600-size compressor is driven by a pair of turbine stages running on the reduced 500-size airflow. No Palouste 600 has yet been made, for such an engine would introduce a new size of compressor larger than that now used on all Blackburn gas turbines.

Apart from the basic alterations (use of two turbine stages, revision of the compressor diffuser throat area and alteration to the turbine nozzle-vane angles) the gas-producing part of the Palouste differs little from standard. The fact that the combustion system is required permanently to operate on a reduced flow is no great disadvantage and corresponds to a 600-series engine at part-power. Originally there was a degree of mal-distribution in the combustion system which has been overcome by adding a new part; thus, the Palouste chamber can be made to standard form and then have this extra piece added.

Alone among the original Turboméca units, the Palouste seemed to Blackburn's to be capable of almost immediate use in Britain. It was a Palouste which was first run at Brough in September 1952 (before the licence was signed); the first wholly British engine was also a Palouste, and it first ran in January of this year. Development of this engine is going ahead against a Ministry of Supply contract for use in the Fairey light A.O.P. helicopter. This Djinn-like aircraft employs a rotor driven by tip jets supplied with air from a single Palouste mounted horizontally in the rear part of the bubble-like fuselage.

As developed for the Fairey helicopter, the Palouste carries an

unusually large number of accessories, some of which are mounted on the forward face of the drive boxes. For D.C. power generation a large generator is fitted, complete with cooling fan, and other equipment includes a starter, vacuum pump for blind-flying instruments and an extra fuel pump to supply the tip jets with fuel during the periods when this is required.

The first Palouste delivered to Fairey's left Brough in Blackburn and General's Rapide during April. This engine is to be used for ground running and initial hovering trials; a Palouste cleared for free flight is now about ready and will be installed later in the Fairey prototype. A 150-hr rehearsal type test has been successfully undertaken and most of the effort is currently directed to raising the level of reliability of the engine. French Palouste versions are already cleared for use on a 1,000-hr cycle, but these units run rather cooler than the British Palouste, and deliver less air.

Paloustes can also be employed on ground trolleys to provide compressed air for air-turbine starters. Although the only air-turbine starters so far revealed are American, such units are being developed in this country.

**Artouste.** Basically, this is a single-shaft engine consisting of the basic gas producer with the rear bearing moved back to allow for a second turbine stage and with an added reduction gear mounted on the front, driven by the forward extension to the main rotor shaft. This reduction gear can assume various forms, and it closely corresponds to that employed on the Turmo, described below. Owing to the presence of this reduction gear, the two main engine-air ducts are turned upwards through 90 deg, and join at a single rectangular-section intake pointing upwards.

Although the Artouste can be used as a turboprop—in which rôle it has two reduction stages and corresponds to the French Marcadau—and for driving helicopter rotors, its most immediate British application is the provision of power for airborne auxiliary generation sets. Using a special version of the Artouste, a standard type of airborne auxiliary power plant is being developed.

**Turmo.** This free-turbine engine consists of the basic gas-producer section with an additional, mechanically independent, turbine added downstream of the compressor turbine and geared down to a rear output shaft. As this engine was not originally designed for aircraft use it has been more extensively redesigned by Blackburn and General Aircraft than any other unit of the family; the work expended on the Turmo has also been influenced by the fact that it is considered probably to have the greatest immediate future of all this series of gas turbines.

As the cut-away drawing shows, the exhaust is taken away through an upward-sloping duct which becomes rectangular in section (12in × 4½in) after passing around the central shroud over the gearbox. The drive from the free turbine may be direct (in which case the output shaft rotates clockwise, from the front of the engine, at from 26,430 to 36,000 r.p.m.), or it may have a single reduction stage of helical gears (anti-clockwise, with 3 : 1 or 5 : 1) or two stages (clockwise, 6.46 : 1, 9 : 1, 10.76 : 1 or 15 : 1) or three stages (anti-clockwise 19.4 : 1, 23.18 : 1 or 32.28 : 1). Thus, the overall output shaft speed can be chosen at any value between 819 and 7,200 r.p.m., in addition to higher speeds with a single 3 : 1 gear.

The output gears are housed in a cast light-alloy box which is carried by a cast inverted saddle member around the lower rear part of the engine; there is no top attachment, owing to the presence of the exhaust duct. For this reason, the installation of the engine has to make provision for taking out the torque load on the reduction gearbox. The work-split between the two turbines is, of course, governed by the fact that the high-pressure stage drives the compressor.

The developed Turmo is now embarked upon incremental running at Brough, and the shaftpower extracted is gradually being raised to the design full-power figure. The Turmo 600 is the standard aircraft unit, although a 500-series engine is expected to find a wide market in the industrial field, and a rugged, easily controlled Turmo 500 is being developed.

One of the obvious applications for the Turmo is helicopter propulsion. Design studies showed that two Turmo 600s would make possible significant improvements to the Westland Whirlwind (S.55 basic design), and design studies were initiated for a pair of Turmos with separate reduction gearboxes. It was found, however, that by coupling the two power sections to a common final drive, something like 350 lb in power unit weight could be saved, and difficulties in the design of the gearing and aircraft installation would also be eased. So the Twin Turmo was born.

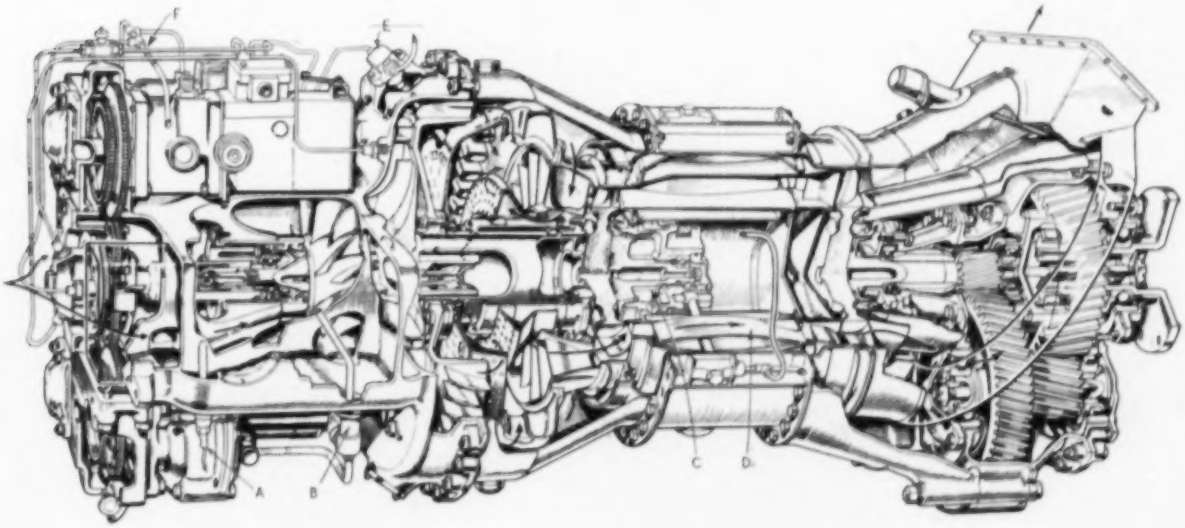
This is a wholly British development, and it comprises a pair of Turmo 600 power sections side-by-side, connected by a common gearbox casing and both driving a single output shaft. The exhaust trunks are turned outwards, to discharge on either side of the engine. Each engine has its own lubrication system and each drives a full range of accessories. Furthermore, the transfer box and reduction gear is so arranged that, if one engine is shut down, the other can continue to deliver power, with the drive to the other unit free-wheeling.

This gives the Whirlwind twin-engine reliability. Calculations indicate that the Twin-Turmo Whirlwind will be able to fly at full load on one-half of its power in temperate conditions, and will even climb slowly. At full power, of course, it will enjoy a greatly enhanced performance. The development of the Twin Turmo is going ahead rapidly, and the first unit should run shortly.

A Twin Turmo is shown in our impression of the new gas-turbine test house now in operation at Brough. It is a requirement for helicopter power units to be capable of operation at the optimum installation angle for the airframe, and the Twin Turmo bed is equipped with a universal dynamometer brake for running at the correct engine angle. In the Whirlwind, the Twin Turmo will be installed at an inclination of about 35 deg.

***Shown for the first time, the Blackburn-developed Turmo 600 is likely to become a very important engine, particularly in the helicopter field. Recent modifications include:***

**A, an oil-temperature bulb replacing a former oil pipe; B, the new oil-tank balance pipe and scavenge return, the filter being transferred to the filler; C, redesigned cooling fan integral with the shaft, stepped labyrinth, and increased cooling airflow, the bearing housing also being lengthened ¾in; D, bearing-housing support lengthened from 2in to 6in; E, redesigned torch igniter (see sketch, p. 755); F, re-routed piping and rubber O-ring-sealed unions.**



# CORRESPONDENCE

*The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.*

### Westland Recollections

WHILST it was difficult to imagine any advance on the "Bristol" issue of *Flight* some time since [February 16th, 1950], in my opinion the "Westland" issue is a better one.

The only drawback I can find is the lack of project data, which possibly originates in a ruling by the company concerned; and the lack of serial numbers.

The following notes may be of some interest:—

(1) Contemporary sources also give the name Wizard to the F20/27 but this does not seem to be official.

(2) The Pterodactyl series are rather enigmatic, due mainly to the fact that not all of Capt. Hill's designs were also those of Westland. However, there seems to be ground for projects 2 and 3 and, in publications of the time, an alternative to the Pterodactyl 5 is shown as an escort pusher fighter with the gunner in front; together with (K 2770), the standard type. After or shortly before Capt. Hill left Westlands a tender to A.M. specification R1/33 was submitted. It was Pterodactyl 7 and was a large G.R. sponson flying-boat of the Lerwick/Sunderland class, but tailless of course.

(3) The Lysander is mentioned with reverence by all who flew it. Its particular merits were seldom so well used as in the "Agent Dropper," properly designated Lysander S.C.W. (Special Contract Westland) of which about twelve were converted in 1941-42 by Fieldings. Its all-up weight was of the order of 10,000 lb, and it formed the equipment of No. 161 Squadron, with V, T and R serials. Up to six passengers could be carried, and the duration was phenomenal. For instance, on the night of March 19th, 1943, machine F for Freddie took one agent on an unsuccessful trip to France, the duration of which was 8 hr 30 min; and, on February 19th of the same year, "Fred" also took one out and brought two back on a successful trip of 7 hr 40 min.

Even in 1947, in the early stages of the Israel-Egyptian war, Lysanders were engaged in border patrols in the Sinai (saw one myself); and in Canada six old Mark 2s were converted to crop spraying with an all-up weight of 10,500 lb and an incredible swath-width of 175ft per track.

The Lysander Delanne tandem wing was a conversion of the prototype P.8 (P6127) to be type P.12 (P for Petter, incidentally). It was, it seems, fitted for a while with a centre fin, used to gather data for a monoplane fighter bomber similar to the Miles F.A.A. Libellula.

(4) Westland also tendered a most interesting design to S 24/37, designated P.11. It was not built, although the Fairey Barracuda and Supermarine 322 were.

(5) Finally, in continuation of the lightplane tradition a tender—one of eleven from Commonwealth firms—was submitted to T16/48 which was eventually won by Percivals and called the Provost. The history of these eleven tenders is quite another story, however.

Higham Ferrers, Northants. ARCHANGEL.

IN your issue for May 13th a correspondent referred to the fact that he had not so long ago seen a Pterodactyl hanging from the roof of a Farnborough hangar. I saw this particular machine myself in 1948 and am of the opinion that it is in fact the first Pterodactyl which was built by Capt. Hill prior to his joining the Westland Company.

I recall the following brief details of the machine, which may be of some interest. The fuselage was triangular in section and apparently a single-seater. Unlike the later Pterodactyls, an orthodox undercarriage was fitted, the tailwheel being at the extreme end of the short fuselage under the aft-mounted engine. Midway beneath each wing was a small triangular-shaped vertical surface. The serial number was J8067.

Doncaster, Yorks. J. E. HOWARTH.

### Jet Pioneers—A Reaction

I READ with interest the comments under the heading "Jet Pioneers" in *Flight* of May 6th.

There is in existence in this country an organization formed in 1945 and made up of the original Whittle team who were employed by Power Jets, Ltd., up to the spring of 1945. They are known as "The Reactionaries," a name chosen for its jet implications, and meet regularly at an annual dinner held on the nearest Saturday to April 12th, the anniversary of the first engine run.

The dinners were originally held at Lutterworth, but recently they have taken place at Farnborough, Hants, the present location of Power Jets (R. and D.), Ltd.

The total membership is just under 100 and although our members are now spread all over the world, our annual gathering is always well supported. A newsletter is prepared each year giving the present activities of the members and is circulated to keep our distant members in touch.

A limited number of guests are invited to attend the dinner, their names being proposed by any member.

I am afraid that we have not yet risen to the heights of our American counterparts in unveiling plaques from 30,000ft, but I can assure you that a good time is had by all at our reunions and that we are still very much a live organization.

Farnborough, Hants. A. SIMONS,
Hon. Secretary, The Reactionaries.

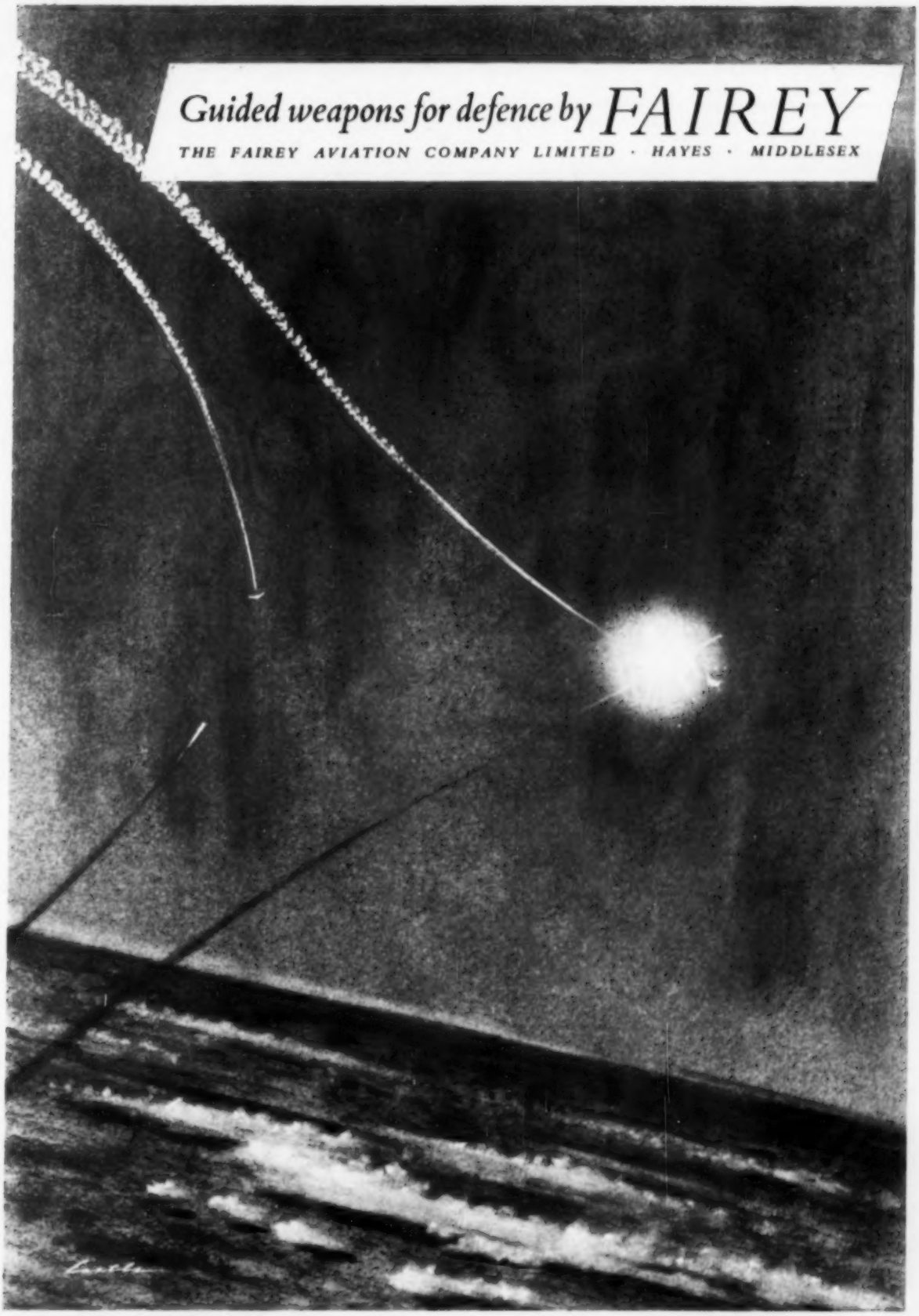
### IN BRIEF

"Granny," who provides her address but omits to give her name, has apparently been having an argument with her grandson about the first Atlantic flights. To settle the controversy: First crossing (by stages *via* the Azores and Lisbon), Lt-Cdr. Read and crew, Curtiss NC-4 flying-boat, May 1919 (west-east). First non-stop crossing (W-E), Alcock and Brown, Vickers Vimy, June 1919. First solo crossing (W-E), Lindbergh, Ryan monoplane, May 1927. It was probably the last-named that "Granny" remembers having seen land at Croydon—he continued from Paris, where his Atlantic flight ended.

In contrast to "Granny," a Berlin reader—Herr Hermann Hirsing—gives his name but no address. He writes enquiring about the possibilities of finding a firm that would make him a miniature (12ft long) airship envelope of goldbeaters' skin, a material once commonly used by manufacturers of lighter-than-air craft. He encloses a sample from an envelope made for him many years ago by the Zeppelin company. If he will provide his address, we can give him the name of a London firm that can supply the material. Meanwhile, any others in a position to assist may care to make the fact known.

## REALISM IN MINIATURE: A PULSE-JET-POWERED SABRE

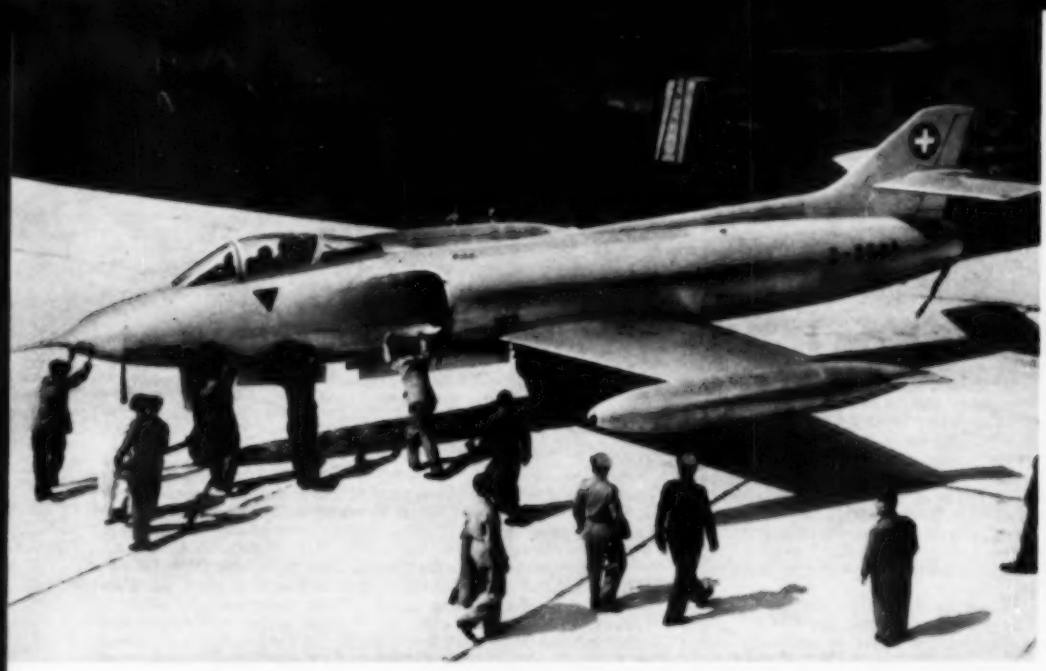
*Though we seldom publish photographs of models, we make an exception of this remarkable F-86F, the work of Mr. P. Donavour-Hickie—aided, as he says, by "Flight" data. Mild steel (22 s.w.g.), aluminium, plywood, balsa and Fibreglass are among the materials. A Dynajet (4.5 lb static thrust) provides the power. Wing span is 37 in and weight just under 6 lb.*


Guided weapons for defence by FAIREY
THE FAIREY AVIATION COMPANY LIMITED · HAYES · MIDDLESEX

*Congratulations to the Gloster Aircraft Co. Ltd.*

**Martin-Baker**

AIRCRAFT COMPANY LIMITED



***The F.F.A. P-16 attack prototype, powered by an Armstrong Siddeley Sapphire, has now done several hours flying (an in-flight view was published in our May 23rd issue). Points of interest are the almost-flush intakes, the very thin sharp-edged wing, with large plain flaps and drooping ailerons, the twin 30mm Oerlikon 302RK guns and the six wheels.***

# AIRCRAFT INTELLIGENCE

## U.S.A.

*Boeing* 707. Metal-bonded sandwich panels, with a metal honeycomb in the centre crushed around the edges by a Hydro-press, are used in the flaps, inboard ailerons and trailing-edges of this American prototype. According to *Aviation Week*, Boeing are developing a method of machining honeycomb by means of an electrode.

*Convair F-102A.* It is reported that the performance of this all-weather intercepter will shortly benefit from the extra thrust provided by the new Pratt and Whitney J57-P-35. This type of J57 delivers no less than 17,200 lb thrust when the afterburner is brought in, an increase of 1,200 lb over the engines at present fitted. Later production models of the F-102 are to be powered by Pratt and Whitney's forthcoming J75 turbojet, in place of the Wright J67 originally selected.

*Boeing B-47 Stratojet.* Government Aircraft Plant Six, at Marietta, Georgia, which is at present building B-47Es under Lockheed management, is to manufacture 15 B-47s specially equipped with the MA-2 radar bombing system developed for the Boeing B-52 long-range bomber. Designated YB-47J, this Stratojet variant will be employed by Strategic Air Command as a crew-trainer, in order to have fully- or partially-trained crews ready for the B-52Bs as the latter are delivered.

## Netherlands

*Aviolanda AT-21.* At their works in Papendrecht, the Dutch Aviolanda Company (who also help to make Hunters) have designed and built an electronically controlled target with this designation. The AT-21 is built largely of plastics, the nose being of sandwich construction. Power is provided by a SNECMA-Aviolanda pulsejet delivering between 100 and 190 lb thrust. The AT-21 has a span of 13ft, a length of almost 20ft and a weight of 660 lb. A special hit-recorder is carried and two parachutes are employed in landing.

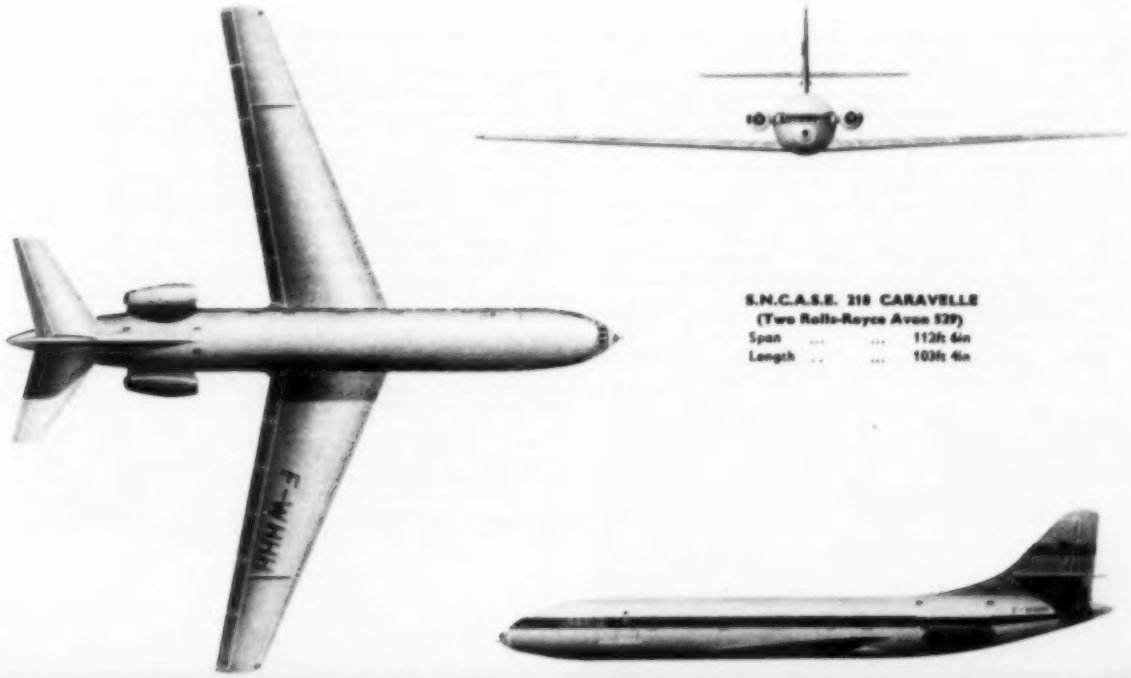
## France

*S.E. Vampire with Thrust Reversal.* Three years ago the S.N.E.C.M.A. company demonstrated their Vampire equipped with a reverse-thrust device of their own design and manufacture. It is known that retraction of the characteristic rings has been successfully tested, and that an Atar turbojet has been fitted with the device.

*S.N.C.A.N. N.C.856.* Of 112 N.C. 856 A.O.P. machines ordered from S.N.C.A.N. at Bourges, 90 had been delivered by the beginning of June. One float-equipped model, the N.C.856H, was handed over last month to Prince Rainier, of Monaco, for his personal use.

## Czechoslovakia

*Czech-built Helicopter.* The prototype of a two-seater helicopter has been constructed by the Czechoslovak industry, and quantity production will begin shortly. The qualities of this machine are said to be "well up to world standard," and the type will be suitable for training and general purposes.



**S.N.C.A.S.E. 210 CARAVELLE**
**(Two Rolls-Royce Avon 529)**

| | | |
|---|---|---|
| Span | ... ... | 112ft 6in |
| Length | .. ... | 103ft 4in |

# ILSY 5

## *Golden F.A.I. Display: Hunters, Sabres and a Sopwith Pup*

"Flight" photographs

*(Above) Over the heads of the vast crowd: "Bill" Pegg demonstrates the Britannia. (Left) The new U.S.A.F. "Skyblazers" are now using F-86Ds for their brilliant aerobatics; they are from the 12th Air Force.*

NOT only by reason of the fact that a Sopwith Pup and a Hawker Hunter appeared on the same flying programme was the fifth International Air Show at Ypenburg last Monday an exceptional affair. The scope of the display was extraordinarily wide, for it featured the combined efforts of seven nations, the cream of the world's formation teams, and a most representative selection of aircraft. For most of the afternoon a bright blue sky formed the backdrop and a hot sun quietly baked the spectators—all 150,000 of them—ranged alongside Ypenburg's proud new 2,700-yard runway.

Organized by the Royal Netherlands Aero Club in collaboration with the Royal Netherlands Air Force, the display—officially designated *de Vijfde Internationale Luchtvaartshow Ypenburg*—formed also the "Golden F.A.I. Air Display" marking the 50th anniversary of the *Fédération*. Captain K. J. G. Bartlett, president of the F.A.I., declared the show open, following the arrival of Queen Juliana and Prince Bernhard (in a DC-3 flown by Lt-Col. Gerben Sonderman) and a welcoming address by the chairman of K.N.V.v.L., the Royal Netherlands Aero Club. A stream of light aircraft, variously flown by Dutch private pilots, flying-school instructors and the U.S. Army, then swept in to spray the runway with flowers.

Meteors of the Royal Netherlands Air Force and U.S.A.F. F-86D Sabres then combined in an opening fly-past, forming the letters "F.A.I." and the figures "50" against the blue sky. There followed formation aerobatics by three R.N.A.F. Grunau Baby gliders, and then Ranald Porteous demonstrated the Auster A.O.P.9. Various other demonstrations followed, but a noteworthy aerobatic item was a brilliant effort in a Lignel 44 by Louis Clément, "the flying Burgomaster of Adainville"; one of the craziest crazy flying demonstrations we have ever seen, it included a low run with the pilot waving his arms above his head.

After a fly-past by 50 assorted aircraft of the R.N.A.F. and the Royal Navy, two groups of four Sea Hawks of Nos. 800 and 807 Squadrons, executed formation aerobatics, and three Fairey Gannets made a straight run-over. Yet all this was, so to speak, only an introduction. There were no fewer than 36 separate items in the programme, so here it is possible to refer only to high spots; we hope to give further illustrations and information next week.

A dog-fight between a Sopwith Pup flown by W/C. R. F. Martin, Gloster chief test pilot, and a Bristol Fighter (Lt-Cdr. W. Stuart of the A. and A.E.E.), both from the Shuttleworth Collection, was punctuated by a treble supersonic bang; the originator, it transpired, was Fokker chief test pilot Sonderman in a Hunter, who then made a low pass. Later, Sonderman gave a spirited display of aerobatics in a Fokker S.14 jet trainer, performed in company with another of the same type.

No. 43 Sqn., R.A.F., put up the expected brilliant display in their Hunters, changing formation during loops and other manœuvres; the pilots were S/L. R. Lelong (leader), Sgt. T. E. Lampitt and Sgt. N. Lamb. Some fine individual Hunter aerobatics were also contributed by F/L. A. F. Jenkins of No. 222 Sqn.

Tied-together aerobatics were performed by three R.N.A.F. Harvards; and another, just-as-tight, formation—though *not* tied-together—was by the U.S.A.F. "Skyblazers," who are now mounted on F-86D Sabres. Like the Hunters, they demonstrated formation changes in loops and climbs. Still more formation aerobatics were contributed by four Italian Air Force Thunderjets.

Seventeen women were among the 54 parachutists, most of whom jumped from Dakotas, variously with free and static-line parachutes. A Frenchman, Michel Prik, made a 45-sec delayed drop. Second A.T.A.F. contributed a fly-past by four Canberras; No. 266 ("Rhodesia") Sqn., R.A.F., staged formation aerobatics in their Venoms; and three Orenda Sabres of No. 4 Fighter Wing, R.C.A.F., dived supersonically. Among individual civil aircraft were the Bristol Britannia—an excellent Farnborough-style demonstration by "Bill" Pegg—and a Heron (Pat Fillingham).

The famous Major Charles E. Yeager gave a high-speed demonstration in an F-86D, and soon afterwards the whole brilliant affair ended with three treble supersonic bangs—made anonymously—and a massed fly-past.

# THE SECOND ROUND

## *Another of the National Air Races Series*

AT Yeadon last Monday the second round of this season's National Air Races was flown. The weather was perfect, the crowd large, and the races in many cases as exciting as one could wish. In fact everything (at least from the Whitsuntide spectators' point of view) went off with hardly a hitch. The controllers had a less carefree time, but their efforts, under the supervision and chairmanship of Air Chief Marshal Sir Philip Joubert, were well directed and supported by an impressive galaxy of Army, Fire Service and police radio-networks.

The races themselves were interspersed among display items, in this order: the Goodyear Trophy race for Geminis; the Norton Griffiths Trophy race for Tiger Moths; the S.B.A.C. Cup race for the faster aircraft; the Air League Cup race for Proctors; the Kemsley Trophy race for the medium-speed types; and the Grosvenor Cup race for the slowest of all.

The afternoon's programme opened with some polished aerobatics by four Meteor 8s from No. 608 Sqn., R.Aux.A.F.; then minds were turned to competitive affairs as three Geminis, one golden, and flown by P. Blamire; one silver and black, flown by Fred Dunkerley; and the third pale blue, and flown by Nat Somers, prepared to do battle. To make the handicappers' dream come true and reach the finishing line together the last two had to make up 1 min 41 sec and 2 min 11 sec handicap respectively. But the dream was not to be, and Blamire held his scratch lead to the end. The real battle developed between Dunkerley and Somers, with the first fighting gallantly to shake off the ruthless and skilful pursuit of the second. Just as Somers overtook his man, however, Dunkerley's aircraft blew a cylinder head and forced him to retire.

*The finish of the Goodyear Trophy race, with P. Blamire holding off Nat Somers to win by a margin of a second.*

"Flight" photograph

There followed a pause for gentler sport, with "Tim" Wood throwing the Blackburn B.2 round the sunny sky. In the hands of the master of Beverleys this machine is still as agile as any of its erstwhile companions. As the B.2 landed, the announcer drew the crowd's attention to a red and cream Slingsby Sky high overhead, just casting off from a Tiger Moth. And attention was well and truly held as the Sky's wing flexed to a series of perfect loops and stall turns, under the direction of Gerard Smith of Rolls-Royce.

Back to business once more with the Norton Griffiths Trophy race, and five Tiger Moths got away to a massed start that would have been the envy of an aerobatic team. The last two had, in fact, a three-second handicap, but even vicious slipstream effect didn't prevent them trying to overcome their lag straight away. Basil Maile, one of the last, actually forged straight into first

place, held his lead, and won at 104 m.p.h., followed by J. H. Denyer and Beverley Snook. The Hon. Peter Vanneck, his machine loaded down (so he said) with splendid coats of glossy black paint, fought for and held fourth place, flying very low. J. M. Donald took the high-level road, but could not get the necessary speed from his final dive to the finishing line to make up a very slight lag.

The next six minutes were to have been given to the U.S.A.F. Thunderjet team, but having arrived overhead 27 minutes early they were short of fuel by the time their turn came and they departed for their next port of call, Sherburn-in-Elmet, without showing themselves through the heat-haze. The next two items, however, more than made up for their absence. First a Training Command Provost, flown by Master Pilot R. Drown, was thoroughly wrung out—in a full-blooded tail-slide, for instance, followed by a hammer stall and aileron turn.

Then, making its first appearance in England, came the Sipa 200, which had been flown over by Alain Hisler, an instructor at St. Yan. The little Venom-like machine roared backwards and forwards over the runway, piloted through a series of most delightful aerobatics at extremely low level. The final masterpiece was a flawless eight-point hesitation roll at a hundred feet.

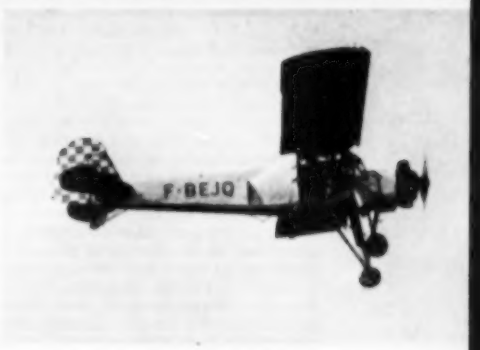
The fast brigade—Marler's Falcon Six, Ron Paine's Hawk Speed Six, Dunkerley's Sparrowjet and his Mew Gull (flown by P. Clifford)—in that order, next got ready for the most high-powered race of the afternoon. The Sparrowjet was racing for the first time, and Dunkerley made good use of 660 lb thrust to beat the Mew Gull. But this time the handicap, and not the engines, deprived him of victory, and in an exciting finish Ron Paine came in first, with Marler, Dunkerley and Clifford, in that order, seemingly at fifty-yard intervals behind him.

The most exciting part of the Air League Cup race for Proctors was the start. The first off, Barker's Proctor 3, ground-looped across the starting line and zig-zagged off down the runway; T. G. Knox's black machine, close behind, developed violent tail-wheel shimmy, slowed down and badly baulked V. Edwards, who was going off with him. But no harm was done and they finished in their starting order, but with Noel Husbands' Proctor 1, still plagued with a recalcitrant C.S.U., well behind.

In the interval between this and the Kemsley Trophy race a Canberra B.2 made some slow and fast runs. The crowd gasped when F/L. D. Rhodes, from C.F.E., brought his Hunter, with a great crack of sound, across the field. He returned, "everything down" at a mere 150 kt or so and then showed some tight turns with flap down. His most impressive effort was unfortunately lost to view of most: he finished with six upward rolls.

In the Kemsley Challenge race, with David Ogilvy in the Comper Swift, D. W. Phillips, a newcomer in a Hawk Major, Wheatley in his Globe Swift, "Johnny" Johnston in a Hawk Trainer and Nat Somers in his Chipmunk, the Hawk Major dropped steadily back to last place. The Comper on the other hand very nearly made it, and ploughed valiantly on from a scratch start in splendid isolation from the rest. But Nat Somers forced on, with 46 seconds handicap, and wrested the lead from the Comper a bare quarter mile from the finish.

Close on the Kemsley followed the Grosvenor Challenge Cup race with three Autocrats, a Taylorcraft, Jimmy Edwards' Aiglet and the Chilton, managed by J. Appleyard. It was Gregory in the Taylorcraft (second away) who won, with J. Grummett and J. F. Morgan in Autocrats close on his tail. D. Westoby in the Aiglet had had 1 min 12 sec handicap and followed the first bunch home into fourth place.




*Above, Ron Paine gets away in his Hawk Speed Six in the S.B.A.C. Cup, which he won from Geoffrey Marler. On the right is the Salmson-engined Storch used by the French parachutist, Léo Valentin.*

"Flight" photographs

The final event was to have been the descent, with wings, from 9,000ft, of the French parachutist Léo Valentin. Owing to trouble with his wings his turn had been postponed till the last, and not until just before the final race did his Storch take off. For some thirty minutes it climbed infinitely slowly. At one time it was actually losing height, and finally it gave up the struggle and started back for the field, not without a sigh of relief from some of those present.

**RESULTS**

**S.B.A.C. Cup.**—1, R. R. Paine (Hawk Speed Six), 177 m.p.h., *28* points; 2, G. Marler (Falcon Six), 158.4 m.p.h., *26*; 3, F. Dunkerley (Sparrowjet), 193.5 m.p.h., *12*; P. Clifford (entrant, Dunkerley) (Mew Gull), 195 m.p.h., *23*.

**Goodyear Trophy (Geminis).**—1, P. Blamire, 138 m.p.h., 29 pts.; 2, J. N. Somers, 166.5 m.p.h., *26*; F. Dunkerley retired in last lap, *13*.

**Norton-Griffiths Trophy (Tigers).**—1, B. Maile (entrant, N. Jones), 104 m.p.h., *34* pts.; 2, J. H. Denyer, 103.5 m.p.h., *33*; 3, B. J. Snook (entrant, N. Jones), 101.5 m.p.h., *24*; 4, The Hon. P. Vanneck, 100.5 m.p.h., *15*; 5, J. M. Donald, 100.5 m.p.h., *16*.

**Air League Cup (Proctors).**—1, B. Barker (entrant, E. Crabtree), 136.5 m.p.h., *17* pts.; 2, T. G. Knox, 136.5 m.p.h., *31*; 3, V. Edwards (entrants, Reeks and Hugh), 134 m.p.h., *12*; 4, E. Noel Husbands, 131 m.p.h., *22*.

**Kemsley Trophy** and **Grosvenor Cup.**—No official results available at time of going to press.

# THE W.J.A.C. at WHITE WALTHAM

IN some ways a counterpart of the A.T.C., though enjoying only nominal Government support, the Women's Junior Air Corps is an organization for girls of between 14 and 20 years of age, with units throughout the country. Its stated aims include the inculcation of "an intelligent air-mindedness", in pursuit of which it offers, among other things, the award of two or three flying scholarships a year and the opportunity of an occasional flight in G-AIYO *Grey Dove*, the Corps' Fairchild Argus.

At White Waltham airfield on Whit-Monday, in perfect weather, the Corps held its third annual rally and flying display. The rail strike prevented some of the more distantly situated cadets from attending, but did not preclude a record crowd.

The flying display was a modest affair, without pretension to major spectacle, but there were some entertaining interludes at unexpected moments—the more unexpected because the public address system, early in the afternoon, also went on strike.

After a fly-past by W.J.A.C. scholarship winners in a variety of light aircraft, and a march-past of cadets at which Lady Slessor, W.J.A.C. vice-president, took the salute, there were various light-aircraft and glider competitions and demonstrations, the latter including Prefect aerobatics, with some nice tight loops, by P/O. "Mickie" Gilbert, W.R.A.F.V.R. John Crewdson demonstrated the Agusta-Bell 47D helicopter, and later did a roaring trade in joy-rides at £1 a head.

Four Meteors of No. 500 (County of Kent) Sqn., R.Aux.A.F., led by F/L. Scrimgeour, made several passes in various impeccable formations, though departing (as is inevitable in jet-aircraft "air drill") for extensive circuits of the surrounding countryside between each; Territorials and National Servicemen of the 11th Parachute Bttn., T.A., hurtled earthward from a paratroop training balloon, a white or a khaki canopy blossoming above each at the dictation of a static line; R.A.F. Police dogs from No. 3 P.D. Training Sqn., Netheravon, obviously delighted the crowd; and F/L. R. M. Williams, from Home Command Gliding Instructors' School, Detling, appeared in an aero-towed primary glider of the most rudimentary kind—which, having been cast off, he conducted earthward in a sinister-looking succession of stalls.

London University Air Sqn. (S/L. Urwin and F/Ls. Haward, Garwood and Smith) Chipmunks contributed zestful aerobatics, as did a single Chipmunk from Home Command Examining Unit; the Vintage Aeroplane Club were represented by Ron Gillman (Avro Cadet), Denis Sweeting (Spartan Arrow) and Capt. Watson (Tiger Moth); and Jock Millet, David Gurney and Ronald Mays with a Piper Cub and a Tipsy put on a really amusing "cops and robbers" act. Finally, a relay race between the Women Pilots' Association (Lettice Curtis, Tipsy; Joan Hughes and Mickie Gilbert, Tigers) and the Fairey Club (Toms and McDougall, Tigers; Gurney, Tipsy) was won by the former. Thereafter the W.J.A.C. cadets had their joy-rides in the Argus, with Miss Freydis Leaf, the display's organizer, at the controls.

# FOKKER F.27

## *Holland's Up-and-coming Feedliner:*

THE appearance of actual aircraft on the DC-3 replacement scene comes as a welcome change after the many thousands of words that have been expended on the subject over the past ten years. After living for so long on verbal and written pronouncements made by or directed at the operators, manufacturers, Press and public, it is indeed heartening to have tangible hardware in existence—especially the type of hardware that consists of almost-complete flying machines. This article is concerned with one such aircraft—the Fokker F.27 Friendship, soon to take the air.

It is no new concept that "no such animal" as a true DC-3 replacement exists; and certainly no modern aircraft complying with I.C.A.O. requirements can replace in every respect the economy and relative performance of the ubiquitous Dak. The new generation will have refinements, and, indeed, improved performance on certain criteria, but a compromise is called for somewhere. An order of importance must be assigned for each particular aircraft, to such variables as payload, range, speed, take-off and landing performance, economy, versatility, simplicity in structure and in maintenance.

The design staff of the Dutch Fokker company chose the middle road for their contender in the DC-3 replacement field. Their specification was, however, based on two firm factors and one strong preference. Market research and an analysis of the world's scheduled air services had pointed strongly to the need for a 28/36-seater machine, with an optimum stage-distance of some 300 miles. To this basic specification was added the preference for the Viscount-proved Rolls-Royce Dart turboprop, mainly for reasons of favourable specific engine weight, improved maintenance, lack of vibration, and decreased fire-hazard, in comparison with modern piston engines.

To obtain an up-to-date impression of the end-product of the Fokker company's work on this project over the past four years, *Flight* recently visited Schiphol, successfully survived the company's tight security-scrutiny (concerned entirely with the Dutch-built Hunters, it should be added) and was shown the prototype F.27. During the period of our visit the fuselage, with centre-section attached, was moved—at six o'clock one morning—out of its jig; considerable further progress has since been made, and the completed machine is likely to fly in August or September.

Points of immediate interest in the Friendship are the advanced Redux-bonding techniques employed (to a greater structural extent than in any other aircraft) and the high proportion of British components used, such as the powerplants and undercarriage. No one who visits the Fokker factory can be left in any doubt as to the enthusiasm of all who designed and are building this promising feederliner, two of which are on order for K.L.M. An account of the development, design and construction of the F.27 follows, together with notes on the first four machines and the tests to be made on them.

### Development

It was, as mentioned, with the basic objective of providing a sound DC-3 replacement that the Fokker design team started work. The new machine would be faster than the venerable Dak, and cabin pressurization was required, yet the aircraft had to be simple, rugged and versatile. Market research had pointed to a 28-seater with a large freight capacity.

The main reasons for choosing a high-wing layout were those of increased aerodynamic efficiency, faster ground loading and improved passenger view. And high wings, incidentally yet agreeably, were also in keeping with the Fokker tradition shown in the company's famous inter-war line of transports—including Amelia Earhart's F.VII/3m *Friendship* of 1928. Landing and take-off performance was important, and so a high aspect-ratio was adopted, together with a high-efficiency compound flap.

The basic and detailed configurations of the Friendship were arrived at after an extensive programme of wind-tunnel testing which began in May 1951 at the National Aeronautical Laboratory in Amsterdam.

The original pressure-cabin design was of circular cross-section for most of its length. The incorporation of longitudinal beams beneath the floor to strengthen the fuselage in case of wheels-up landing produced a slight weight penalty, however, and this was overcome by increasing the radius of the cross-sectional arc below the floor, i.e., decreasing the depth of the under-floor portion.

It was decided to use Redux metal bonding to as great an extent as possible, on flat and single-curvature sections, in order to save weight and labour. The two main applications were (1) in the laminated spar booms and wing skins, and (2) in the more conventional stringer/skin bonding on fuselage, wings, and tail unit.

### Design and Construction

The F.27 Friendship is a high-wing all-metal monoplane, employing stressed-skin structures and metal bonding to a marked extent. The production version will be powered by two Rolls-Royce Dart 511 engines and will have 12ft-diameter Rotol airscrews; the prototype has Dart 507s and normal Viscount-type 10ft airscrews.

**Fuselage.** The fuselage, which is of stressed-skin, semi-monocoque construction, consists basically of two main assemblies, the front section and the main section. There is an abrupt change in section of the upper portion of the pressure cabin at the junction between the two, from the elliptical cross-section of the nose portion to the circular one of the major length of the cabin. As mentioned, the cross section of the main cabin comprises two circular segments of different radii, the cabin floor forming the boundary.

The front fuselage is constructed of vertical frames and Z-section longitudinal stringers, covered by 0.6 mm, 24-S.T. light-alloy sheet as far forward as the front pressure bulkhead. This bulkhead carries the machined nosewheel bracket, a shaped nosewheel cover, and vertical and horizontal stiffeners. Forward of the bulkhead is the moulded Fibreglass nose (incorporating frames and nosewheel doors of the same material), housing the single nosewheel and a taxying lamp.

The stringers in this double-curvature section are riveted to the skin, as in the built-up longitudinal spar which runs along the top of the freight-door cut-out and forward to the cockpit canopy. The Redux-bonded framework of the canopy is riveted to the front-fuselage structure, and extends back to the bulkhead immediately behind the pilots' seats. Behind the starboard side of this bulkhead the racked radio equipment and batteries are located; on the port side is the pneumatic equipment (the Friendship has no hydraulics); and between them is the cockpit access aperture.

The freight compartment behind the cockpit incorporates a reinforced floor which is capable of accommodating loadings up to 100 lb/sq ft. The sliding freight-compartment door measures 4ft × 3ft 7in and opens by moving inwards and upward between rails. Aft of the door, at the junction of front and main fuselage-sections, the change from elliptical to circular section (above floor level) is made by means of a shaped frame containing apertures through which the control-runs emerge from the pressurized section of the fuselage. The "step" is illustrated below.

The main section of the fuselage, as far back as the rear pressure

*Left, the "step" in the pressure-cabin roof at the junction of the nose and main fuselage sections, looking towards the nose. Right, the outer port wing/fuselage attachment, comprising link fittings on the front spar of the centre-section.*

# FRIENDSHIP

## *Basic Simplicity Plus some New Techniques*

bulkhead, is of the two-radius section already mentioned. The upper part (that above the cabin floor level) is constructed of main frames, form frames, Z-section stringers and 24-S.T. sheet skinning. In the cylindrical section the stringers are Redux-bonded to the skin, and the main frames are riveted through angle-pieces to the skin, and the form frames are riveted to the stringers to prevent buckling under compression. In the double-curvature section near the door the stringers and form frames are riveted to the skin. There is a degree of flexibility in the construction of the main fuselage in that it can be made up by joining five sub-assembled sections, i.e., the stringers do not run continuously along the whole length. At the end frames of each subsection, the riveted joints are reinforced by Reduxed and riveted gussets.

The design of the window cut-outs aims at maintaining a low general stress-level in the vicinity, and this has been achieved by again employing Redux-bonded reinforcing plates, both over a wide surrounding area and in the immediate vicinity of the riveted window-frames.

The bottom section of the main fuselage was so designed as to provide extra strength against the possibility of an emergency wheels-up landing. It comprises two stiffened longitudinal beams, cross-formers, and longitudinal side-members, all riveted to 24-S.T. light-alloy sheeting. The formers are of a greater radius than the upper-section fuselage frames, and there is a resulting compressive stress on the floor itself. Transverse panels of one-inch-thick metal honeycomb, glued by means of Redux film (together with a ¼-in wide wooden framework) between two 24-S.T. sheets were adopted for this main-cabin floor.

The eight-point wing attachment is based on the four forged fuselage-brackets of 75-S.T. zinc-bearing aluminium alloy. The four-point internal connection is formed by the ends of the brackets being attached to lugs on the appropriate spar; externally, a lug on each bracket projects through the pressure-cabin skin and is connected via a double link to the spar attachment fittings. The lower surface of the centre-section, passing across the fuselage, forms the top of the pressure cabin in that area; and shaped top-fuselage skin sections, accommodating the contour-change immediately ahead of the wing front spar and aft of the rear spar, are joined to the centre-section by means of Z-section attachment pieces. At all internal joints in the pressure cabin, E.C. sealing compound is applied.

Fillets between the "step-down" in fuselage section and the wing leading-edge ensure a smooth change in cross-section and accommodate control-cable runs along the top of the fuselage. The dorsal fairing (running above the elevator and rudder-cable tunnel) aft of the wing is constructed of light ribs and longitudinal stringers.

The main passenger entrance on the port side measures 5ft 5in × 2ft 5in, the sliding door moving inwards and rearwards. The standard 28-seat interior layout is as shown in the diagram, the lightweight double-seat units being of Fokker/Rumbold design. The seats are directly attached, through the floor, to the longitudinal crash-members beneath, and are capable of withstanding a deceleration of 9g, facing fore or aft.

Emergency exits are combined with two of the cabin windows, and a floor-level emergency exit, 3ft 8in × 2ft 5in, is provided on the starboard side of the cabin, opposite the main entrance door. In the pilots' cockpit, the aft-sliding starboard side-window, 19in × 22in, is available as an escape route.

Behind the rear pressure-bulkhead—which is stiffened vertically and horizontally—the air-conditioning equipment is to be located. The tail-cone itself, of conventional construction, incorporates riveted stringer/skin techniques on the prototype aircraft, but Redux will be used for production machines.

**Wings.** The Friendship wing, of stressed-skin construction, comprises the centre-section, which carries the engine nacelles, and two detachable outer-wing sections. Both centre-section and outer wings possess three main component parts; a rigid torsion cell, leading-edge section and trailing-edge section. The use of 75-S.T. light-alloy in the torsion cell has resulted in a relatively low weight, combined with good fatigue properties.

The torsion cell is formed by front and rear main spars, top and bottom 75-S.T. skin panels, main and form ribs, and closely spaced top-hat-section stringers. The spars are of particular interest, the booms being made up of glued laminations formed into angle-sections and T-sections, as shown in the diagram on page 767. The change in section is effected by progressively reducing the number of laminations along the spar, thus combining optimum strength properties with lightness and simplicity of construction.

Another important use of glued laminations is seen on parts of both upper and lower skins near the six wing-junctions (two centre-section/outer-wing junctions, plus joints between the three skin-and-stringer panels of each outer wing). At these positions, progressively laminated reinforcing panels are glued to the skin.

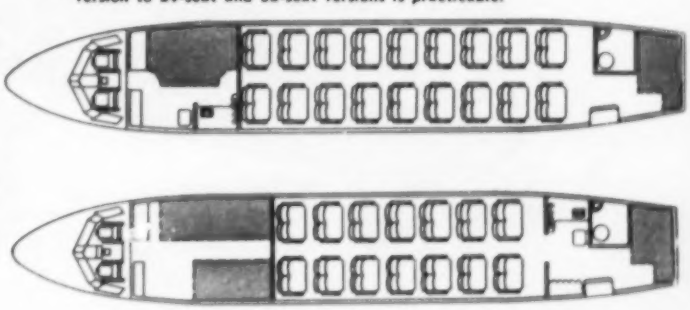
The centre-section has 2 mm (bottom) and 2½ mm (top) inter-spar skins of 75-S.T. alloy, riveted to the bottom stringers and glued to those supporting the top surface. The outer wing incorporates a machine-tapered (from 2 mm to 1.3 mm) skin over the two inboard sections; over the whole length, the stringer/skin attachment is by glueing, with riveted end-sections, bolted attachment rods and glued reinforcing panels at the inter-section junctions. The main attachment of the outer wing to the centre-section, just outboard of the heavy forged centre-section rib, is by means of connecting bars, screwed interleaving doubler plates (top and bottom) and, along the top of the attachment only, riveted fork fittings held by shear bolts. Along the wing, a small number of ribs are riveted to the skin, but the majority are riveted to the parallel stringers, thus assisting (together with the glued stringers) in providing an extremely smooth skin surface.

For the leading edge, which has to accommodate the same elongation as the inter-spar section, Fokker's requirement was for a material with a relatively low modulus of elasticity. The company's work on laminated glasscloth impregnated with polyester resin led to the selection of Fibreglass for the centre-section leading edge and, indeed, for many other similar parts in the aircraft. The centre-section leading-edge assembly includes ribs and U-stiffeners also made of Fibreglass. The same type of material is employed for the outer-wing leading edge on the prototype: in subsequent machines, however, the requirements of the de-icing system will involve a metal leading-edge structure in place of Fibreglass.

The trailing-edge ribs are of mixed plastics and metal construction, riveted to the rear spar, and they support a Fibreglass skin (with metal area aft of the jet-pipe outlet). The rear main spar extends at 60 per cent chord as far as the second joint in the outer wing, where, at the flap/aileron junction, its position changes to 51.25 per cent, remaining thus for the length of the outboard wing section. This will be replaced on series machines by one continuous rear spar.

The integral fuel-tanks are located in the outer wing between the front and rear spar, and between two closed tank ribs, with intermediate tank baffles. The inboard tank rib is adjacent to the wing attachment to the centre section. All joints, as in the pressure cabin, are coated with E.C. sealing compound, and each tank compartment is provided with an inspection panel. Total capacity is 818 gallons. To ensure a continuous fuel flow to the engines and to reduce the residual fuel, a small collector tank with

***Standard 28-seat version provides 282 cu ft cargo space; the 36-seater, 177 cu ft. Each layout features 100 cu ft rear baggage space. Conversion to 24-seat and 32-seat versions is practicable.***



low-pressure fuel pump is located in each nacelle. Port and starboard fuel systems are connected by a crossfeed line.

The Fokker double-slotted compound flap, which extends from the fuselage to the inboard edge of the aileron, combines conventional metal construction with a particularly ingenious method of operation, which we hope to describe fully in a subsequent issue. Its span and chord are respectively 0.70 and 0.30 of those of the wing. The basic structure of each aileron incorporates upper and lower skin panels; front-spar pressing riveted to the skin; rear-spar pressing glued to the skin; main ribs; squarely-built nose section; and three hinge-points. A small amount of leading-edge aerodynamic balancing is provided, in addition to balance-tabs on the trailing edge.

**Undercarriage.** The main undercarriage is an orthodox Dowty-type oleo pneumatic shock-absorber fitted into a telescopic leg, with twin Dunlop wheels, brakes (Maxaret) and tyres.

The leg proper has a hinged joint, approximately two-thirds of its length upwards from the axle, so that it can fold during retraction. This joint is locked in the downward position by a horizontal locking strut to the upper end of the radius rod, and thus the whole structure becomes in effect a pin-jointed triangle.

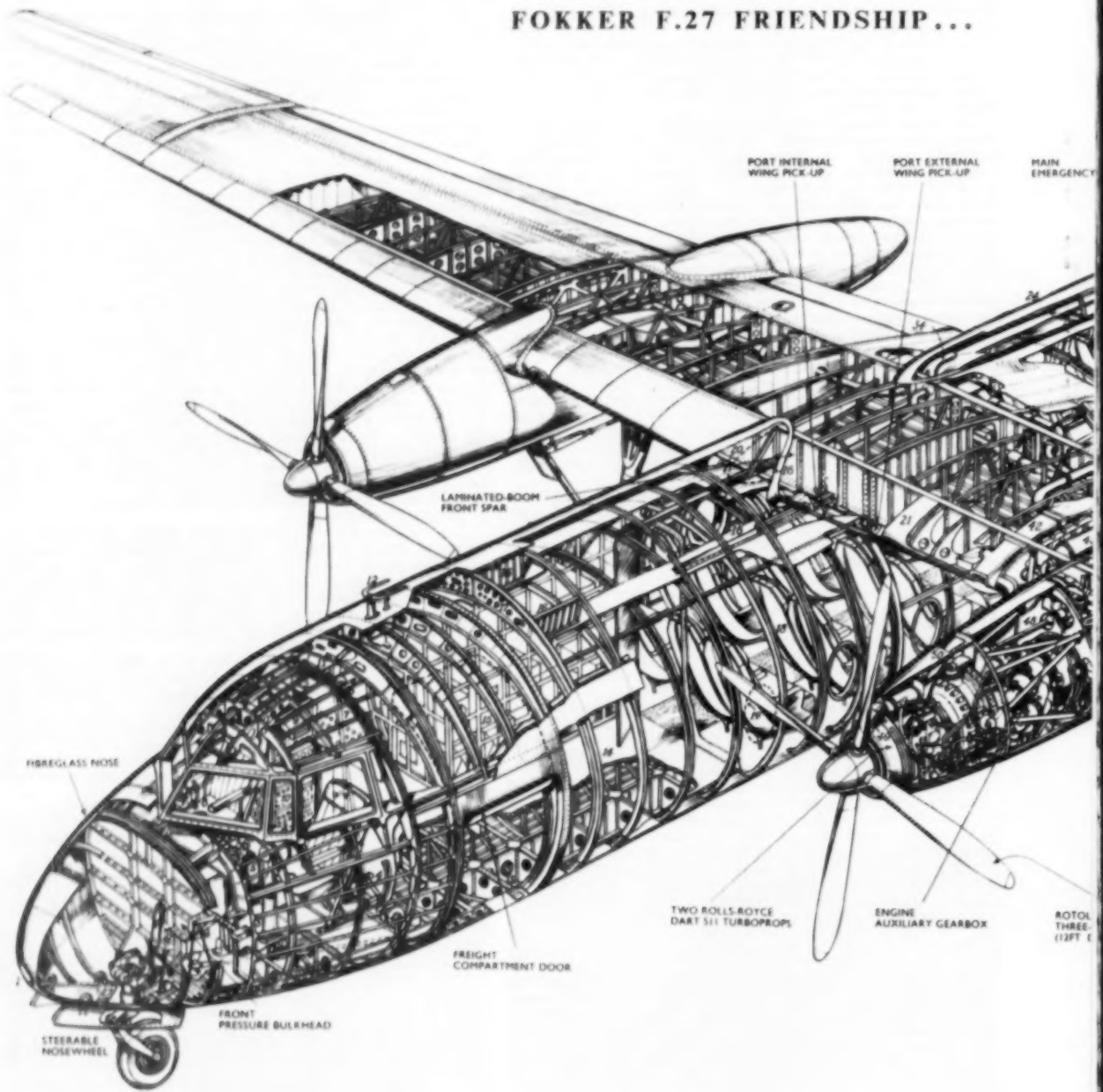
The nose undercarriage is of the Dowty levered-suspension Liquid-Spring type. Power steering is obtained by a Dunlop pneumatic steering-motor bolted to the undercarriage.

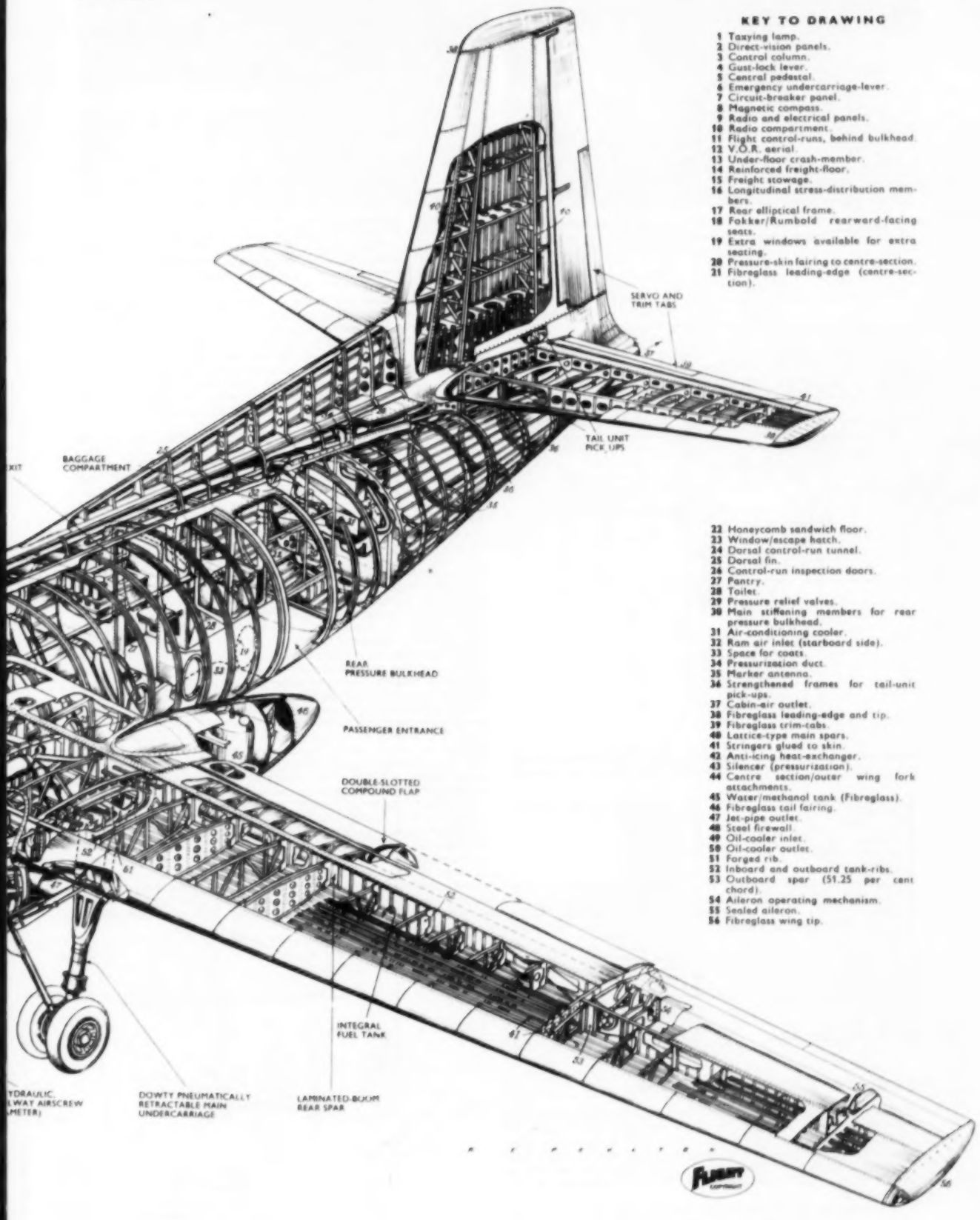
**Tail Unit.** Similar stressed-skin construction to that used on the F.27 wings is employed in the tailplane and fin. On the tailplane, construction difficulties due to the small scale involved have been avoided by the use of cross-over half-rib pressings, riveted via angle-pieces to the close-spaced stringers, which are Redux-bonded to the skin. Half-ribs are attached to the respective skins before assembly with the built-up front and rear spars. Leading edges and tailplane tips are of moulded Fibreglass. The span of the tailplane is 32ft 2in, and total horizontal-tail-surface area is 172 sq ft.

Pressed and built-up ribs, three spars, and top-hat stringers again glued to the skin are employed in the construction of the fin; a Fibreglass leading edge and tip, are incorporated. The fin and rudder together form an area of 129 sq ft. Elevators and rudder are of conventional metal construction, with Fibreglass trim-tabs.

*[Continued on page 766*

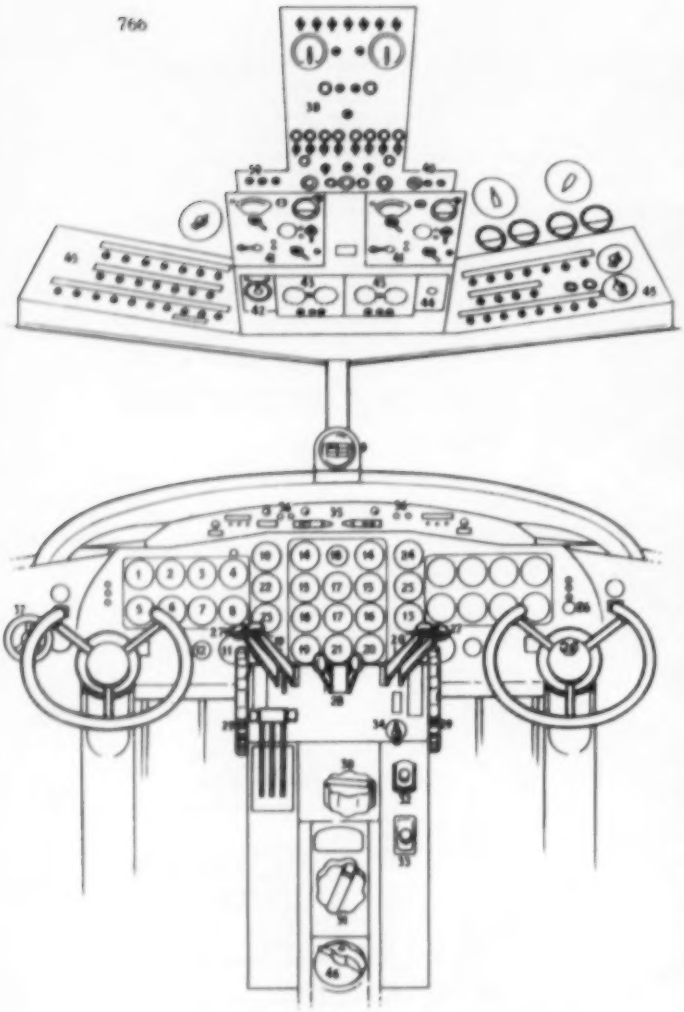
## FOKKER F.27 FRIENDSHIP...






## KEY TO DRAWING

1 Taxying lamp.
2 Direct-vision panels.
3 Control column.
4 Gust-lock lever.
5 Central pedestal.
6 Emergency undercarriage-lever.
7 Circuit-breaker panel.
8 Magnetic compass.
9 Radio and electrical panels.
10 Radio compartment.
11 Flight control-runs, behind bulkhead.
12 V.O.R. aerial.
13 Under-floor crash-member.
14 Reinforced freight-floor.
15 Freight stowage.
16 Longitudinal stress-distribution members.
17 Rear elliptical frame.
18 Fokker/Rumbold rearward-facing seats.
19 Extra windows available for extra seating.
20 Pressure-skin fairing to centre-section.
21 Fibreglass leading-edge (centre-section).
22 Honeycomb sandwich floor.
23 Window/escape hatch.
24 Dorsal control-run tunnel.
25 Dorsal fin.
26 Control-run inspection doors.
27 Pantry.
28 Toilet.
29 Pressure relief valves.
30 Main stiffening members for rear pressure bulkhead.
31 Air-conditioning cooler.
32 Ram air inlet (starboard side).
33 Space for coats.
34 Pressurization duct.
35 Marker antenna.
36 Strengthened frames for tail-unit pick-ups.
37 Cabin-air outlet.
38 Fibreglass leading-edge and tip.
39 Fibreglass trim-tabs.
40 Lattice-type main spars.
41 Stringers glued to skin.
42 Anti-icing heat-exchanger.
43 Silencer (pressurization).
44 Centre section/outer wing fork attachments.
45 Water/methanol tank (Fibreglass).
46 Fibreglass tail fairing.
47 Jet-pipe outlet.
48 Steel firewall.
49 Oil-cooler inlet.
50 Oil-cooler outlet.
51 Forged rib.
52 Inboard and outboard tank-ribs.
53 Outboard spar (51.25 per cent chord).
54 Aileron operating mechanism.
55 Sealed aileron.
56 Fibreglass wing tip.



*Flight instruments in the prototype Friendship cockpit follow a K.L.M. layout, and are duplicated. Auto-pilot installation is optional.*

1 Airspeed indicator.
2 Horizon.
3 Zero reader.
4 I.L.S.
5 Altimeter.
6 Gyrosyn compass.
7 Turn-and-bank.
8 Rate of climb.
9 Magnetic compass.
10 Zero reader heading selector.
11 A.D.F. indicator.
12 Clock.
13 Outside air-temperature indicator.
14 Engine r.p.m.
15 Jet-pipe temperature.
16 Torquemeter.
17 Oil pressure.
18 Synchroscope.
19 Fuel contents.
20 Water/methanol contents.
21 Fuel flow.
22 Flap indicator.
23 Brake pressure.
24 Cabin differential pressure.
25 Undercarriage and flap position.
26 Pneumatic pressure.
27 Throttles.
28 H.P. fuel cock.
29 Elevator trim.
30 Rudder trim.
31 Aileron trim.
32 Flap control.
33 Undercarriage control.
34 Gust-lock safety switch.
35 Fire warning and extinguishing.
36 Feathering and unfeathering buttons.
37 Nosewheel steering.
38 Engine starter controls, L.P. fuel pumps, water/methanol pumps.
39 Main electrical switches.
40 Generator switches.
41 A.D.F. panel.
42 V.O.R. panel.
43 V.H.F. panel.
44 H.F. panel.
45 Miscellaneous electrical switches.
46 Fuel cross-feed cock.

## FOKKER F.27 FRIENDSHIP . . .

**Power Plants.** The prototype Friendship has been fitted with Rolls-Royce Dart 507 engines, which have a take-off rating of 1,540 h.p. This version is in fact a 506 up-rated to give increased take-off power. Production aircraft will be fitted with Dart 511s, giving 1,600 h.p., plus 370 lb thrust for take-off, at 14,500 r.p.m. Fuel consumption of the 511 is stated to be 0.75 lb/s.h.p./hr.

A major difference between the Dart 511 and 510 is the introduction of a reduction gear ratio of 0.86. The Rotol airscrew will be a specially designed 12ft-diameter paddle type, four-bladed and with rounded tips. It is fitted with a third oil-line, independent of the coarse-pitch and fine-pitch oilways, which operates the take-off angle stop and receives its oil supply from the p.c.u. On the lower-powered prototype machine, standard Rotol 10ft Viscount-type airscrews are employed.

The built-up engine-nacelles consist of three sections: (1) nacelle centre-piece, having a fixed connection with the wing and housing the engine-mounting brackets, main undercarriage unit fuel-collector and water/methanol tanks, (2) detachable power-plant, with airscrew and engine cowling, and (3) detachable tail-portion, which houses electrical equipment. At the forward end of the centrepiece is a fireproof steel bulkhead, through which passes the outwards-inclined shrouded jet-pipe.

The Rotol auxiliary gearbox for the engine-driven accessories is mounted flat (with the majority of accessories vertical) in a separate compartment behind the firewall. The auxiliaries comprise a D.C. generator, A.C. alternator, compressors for pneumatic and pressurization systems, r.p.m. generator and synchronizer alternator.

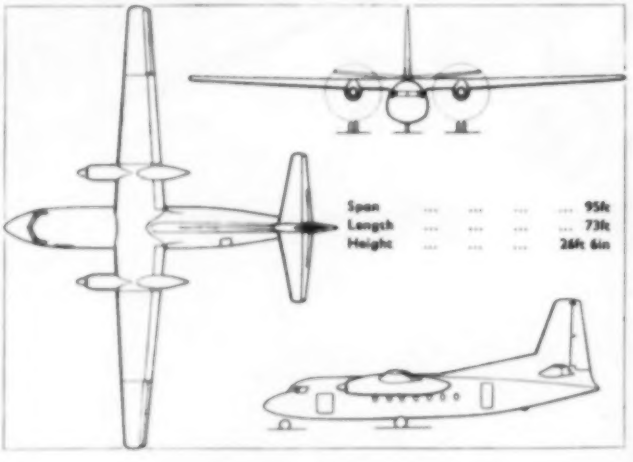
**Cockpit, Controls and Radio.** The appearance of the pilots' instruments and controls in the cockpit is indicated in the drawing on this page. The layout adopted for engine and flight instruments in the prototype is that of K.L.M., whose representatives have been in close touch with the development of the F.27 since its inception. Instruments in production machines will be installed according to the operators' particular requirements. In general, the cockpit appears easily accessible, of ample size, and neatly laid out, yet sufficiently flexible to accommodate additional or alternative installations.

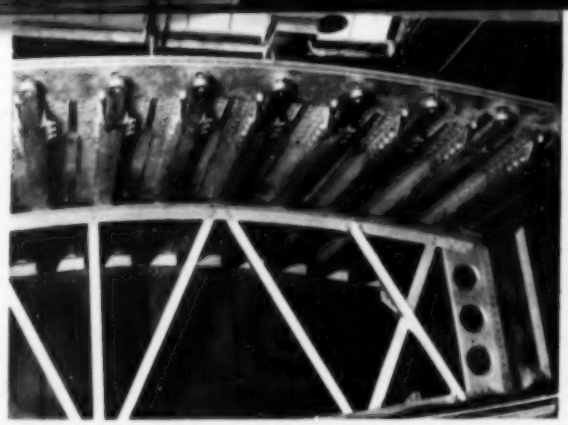
Aft of the cockpit, all engine and flight controls are led up vertically behind the cockpit-entry bulkhead to the top of the front freight compartment, and then rearwards, passing out of the pressure cabin through pressure-sealed holes in the rear elliptical bulkhead. The controls continue aft along the dorsal fillet to the wing centre-section, at which point the engine controls run out along the leading edge of the wing to the engine nacelles. The flight controls (in the form of Lock-clad cables) pass through the centre-section, the aileron cables then being led out aft of the rear spar to the ailerons. The rudder and elevator cables continue along the dorsal tunnel to the tail unit.

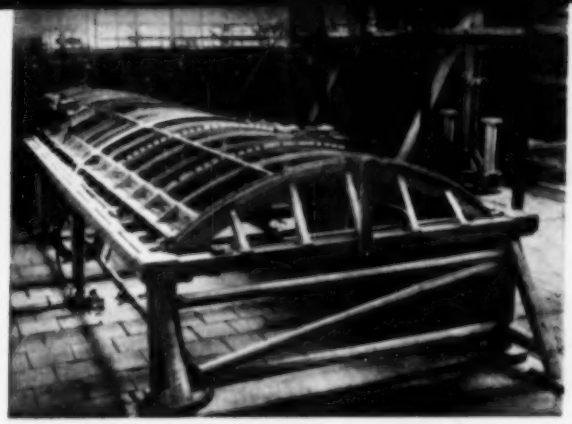
In the cockpit, the gust-lock lever is situated on the bulkhead behind the captain's seat, its function being to lock all the control cables by means of a clamping device behind the bulkhead. A small switch on the central control-pedestal is the "gust-lock take-off safety selector," which allows only one engine at a time to be run above 10,000 r.p.m. with the flying controls locked, thus preventing the possibility of take-off in that condition. The adjustable rudder pedals incorporate toe-brakes, which operate the Dunlop pneumatic braking system (with Maxaret unit).

Front windows in the canopy are bird-proof: the visibility is good, and clear-view panels are provided. The nosewheel steering is operated by a wheel at the left of the instrument panel, and duplication of this control for the first officer is optional. Engine and miscellaneous instruments are centrally mounted on the panel, above which are the feathering buttons for the airscrews, together with fire-extinguisher control levers.

Standard radio equipment on the Friendship comprises: V.H.F./N.A.V. installation (Bendix N.A.-3 or Collins 5.1R-3), glide-path receiver (Collins 5.1V-2), marker beacon receiver (Collins 5.1Z-1), A.D.F. (Bendix N.A.-1), one V.H.F. communications set (Standard S.T.R.-12D), H.F. communications (Collins 18S-4), two intercom positions (Bendix MS-92A), and remote indicating compass (Sperry C2-A). Optional installations include second V.H.F./N.A.V., second glide-path receiver, second A.D.F., radio altimeter, second H.F. communications,







*Left, the upper attachment of the centre-section to the outer wing is by doubler plates and shear bolts through fork fittings. This photograph, showing the centre-section attachment, was taken before the heavy (forging) rib was in place. Right, the lower (under-floor) section of the fuselage in its jig. The structure incorporates two strengthened longitudinal beams.*

**Weights**

| | | |
|---|---|---|
| Normal take-off weight | | 32,630 lb |
| Maximum take-off weight (design o.u.w.) | | 34,200 lb |
| Maximum landing weight | | 32,630 lb |
| Maximum zero-fuel weight | | 30,860 lb |
| Wing loading (normal) | | 43.3 lb/sq ft |
| Power loading (normal) | | 9.7 lb/e.h.p. |
| Weight Analysis (28-seater):— | | |
| Manufacturers' weight empty | 20,610 lb | |
| Crew and stewardess | 473 lb | |
| Operator's services | 242 lb | |
| Operational weight empty | | 21,325 lb |
| Normal disposable load (fuel + oil + payload) | | 11,305 lb |
| Maximum disposable load | | 12,875 lb |
| Maximum payload (limited by zero-fuel weight) | | 9,535 lb |

**Dimensions**

| | |
|---|---|
| Span | 95ft |
| Length | 73ft |
| Height | 26ft 6in |
| Wing area | 754 sq ft |
| Aspect ratio | 12 |

**Performance**

Calculated performance figures based on normal take-off weight of 32,630 lb. (Detailed performance characteristics in graphs on this page.)

| | |
|---|---|
| Max. cruising speed (20,000ft at 13,800 r.p.m.) | 280 m.p.h. |
| Economical cruising speed (20,000ft at 13,300 r.p.m.) | 275 m.p.h. |
| Rate of climb at sea level (I.S.A.) | 1,500 ft/min |
| Rate of climb at sea level (I.S.A. + 15 deg C) | 1,220 ft/min |
| Service ceiling | 35,000ft |
| Operating altitude on one engine ($r/c = 0.02\ V^2_{so}$) | 12,500ft |
| Normal stage distance | 300 miles |
| Maximum stage distance | 1,000 miles |
| Stage speed for normal stage distance | 203 m.p.h. |
| Take-off distance on two engines (I.C.A.O. technique) | 2,400ft |
| I.C.A.O. take-off field length | 3,800ft |
| I.C.A.O. landing field length | 3,800ft |

Effect of increase in usable-fuel capacity from 704 to 818 Imp gal has been to increase maximum stage-distance at maximum take-off weight (34,200 lb) from 810 miles to 980 miles. Over this distance, it is estimated, 28 passengers plus 420 lb freight could be carried.

**Economy**

Original cost calculations, using the revised S.B.A.C. standard method, showed direct operating costs over a 300-mile stage distance to vary from 15d per capacity long-ton-mile at normal take-off weight to 12.8d at maximum take-off weight. Assumptions made included a basic price for the aircraft of £141,000, 3,000 hr/annum utilization, and 8-year amortization period (with residual value 20 per cent).

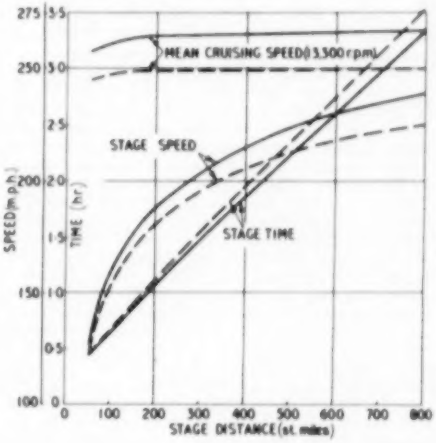
Subsequent labour-cost and development-cost increases have resulted in the Friendship's first cost being raised to £165,000, with a consequent increase in direct operating costs of from 2.5 to 3 per cent, according to range. The effect is to raise the specific figures quoted above by just under ¼d per ton-mile.

autopilot (Smith S.E.P.-2), radio autopilot coupler (Smith S.E.P.-2), flight director (Sperry Zero Reader or Collins I.F.S.), and second V.H.F. communications set.

**Systems.** The pressurization system of the Friendship is designed to maintain a differential cabin pressure of 4.16 lb/sq in —giving an equivalent cabin altitude of 8,000ft when flying at 20,000ft. The pressurized air will be delivered by two Godfrey Type 15 cabin superchargers, one on each engine, each mounted vertically on a drive pad of the appropriate engine-driven auxiliary gearbox.

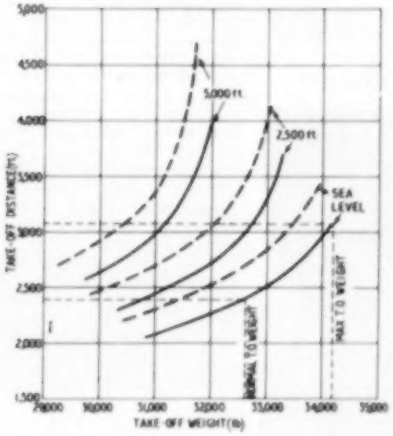
The pressurized air will be delivered through apertures under the luggage racks in the main cabin of the aircraft, and through a separate duct to the cockpit, with take-off points for the pantry and toilet. The outflow will be through the space below the floor and *via* relief valves to an outlet aft of the rear pressure bulkhead. Cabin superchargers, spill valves and silencers are being

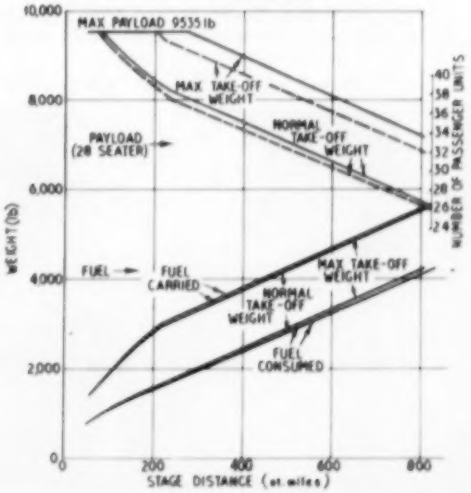
(*Concluded at foot of page 773*)

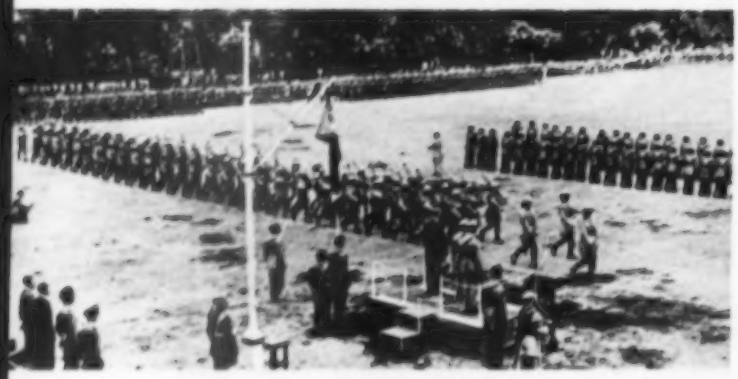



*Above, estimated operating performance for an average of normal and take-off weights. Below, left, runway take-off distances (I.C.A.O. technique). Solid and dotted lines represent I.S.A. and I.S.A. + 15 deg C conditions. Right, payload and fuel-weight variation (temperature influence on fuel negligible); one "passenger-unit" equals 213 lb (including food and luggage).*

*Front spars of centre-section (left) and outer wing illustrate appearance of laminated-boom construction.*





*King Feisal (centre figure on dais) took the salute at a marchpast of Iraqi troops when Habbaniya was handed over to Iraq on May 2nd. (Right) Blenheims of No. 30 Squadron flying near the great Middle East base shortly after it was first occupied. The Euphrates River is on the right, with some of Habbaniya's buildings in the distance. Seen darkly in the distance is Lake Habbaniya, 100 square miles in area.*

# FAREWELL TO "HABB"

## *Memories of the Great R.A.F. Base in the Middle East now Ceded to Iraq*

By FRANK TINSLEY

IT is an accepted fact that under scientific irrigation the Middle Eastern desert will "blossom like a rose," and of this no better proof exists than in the almost fabulous cluster of lovely trees, shrubbery and flowers lying beside the Euphrates River 50 miles from Baghdad.

For there stands Habbaniya, developed in less than 25 years from an age-old desert into a great Royal Air Force station, an airfield-*cum*-Kew-Gardens of the East, as truly a wonder of our time as, in their day, were Ur and Babylonia's Hanging Gardens of Semiramis, whose ruins lie not so far from Habbaniya.

On May 2nd, under the new Anglo-Iraqi Agreement, "Habb" (as Habbaniya is best known in the Royal Air Force) was ceded, with other R.A.F. bases in Iraq, to the Iraqi Government. But although it has now ceased to be British, Habbaniya—with its wonderful irrigation and water-carried sewage systems, stock farm, air-conditioned buildings, prolific sports and recreation amenities, its lovely boulevards, its bund (which British engineers built to combat the Euphrates in flood) and its fine airfield—will always stand a monument to British engineering and imagination.

Habbaniya, which, in Arabic, means "of the Oleander Tree," was born of a clause in the Anglo-Iraqi Treaty of 1930 permitting establishment of a British base west of the Euphrates, and was carefully planned in an angle of that river. By 1934 it was taking shape. Seven miles round, it was designed as the R.A.F.'s permanent headquarters in Iraq, and when the Service first occupied it in 1937 the site was already beginning to assume some of the beauty which is its today. With time, the population and buildings grew until the station reached the proportions of a fair-sized city. Its civil cantonment alone, housing "Habb's" polyglot native employees and their families, was by 1951 a self-contained community of over 12,000 souls, ranking as Iraq's third or fourth largest town.

It is impossible to mention Habbaniya without resorting to superlatives. It was the biggest R.A.F. station in the world, was generally considered the most lavishly appointed and beautifully laid out, and was, perhaps, the most English of all overseas stations. To the "exile" serving there, its very roads and boulevards—28 miles of them within the station's eight-foot-high surrounding fence—breathed the spirit of Britain as he traversed Piccadilly, Kingsway, Cranwell Avenue, Cheapside and other familiarly named thoroughfares.

*Of modernistic design—the Anglican church at Habbaniya.*

Its churches, solid and lovely, resembled those back home; its enchanting flowers—clematis, lilac, honeysuckle and roses vieing with lurid tropical blossoms—were reminiscent of Kew or the Chelsea Flower Show. Palms, towering eucalyptus trees, and English trees, too, sheltered Habbaniya's people from the scorching sun. On its dozens of sports pitches, one heard the crack of willow, the thud of soccer and rugby ball, the smack of the polo stick. Habbaniya's garrison enjoyed three lovely swimming pools, crowded as an English seaside when the shade temperature was 120; and, on the nearby lake, members of the Habbaniya Sailing Club raced their dinghies or cruised over the blue waters.

Militarily, Habbaniya served Britain and the Royal Air Force most notably as a base for operational squadrons concerned with the overall defence of the Middle East; as a staging post for aircraft flying to and from Britain and the Far East; and as an ideal training base for R.A.F. squadrons. As Air Headquarters, Iraq, it was the operational hub from which the Air Officer Commanding ran his Command, embracing Jordan, Iraq, the Persian Gulf area, and Mauripur.

Britain's influence in Iraq dates from the First World War, when, with the defeat of the Turks, Mesopotamia, as it then was, was freed from Turkish domination. Between 1920 and 1922 tribal disturbances racked the country; then, following the Cairo Conference of 1921, Lord Trenchard's scheme for air control of Iraq resulted in the Anglo-Iraqi Treaty of 1922. Air control included punitive R.A.F. action to control unruly tribes by R.A.F. aircraft and armoured-car squadrons based on Baghdad, Shaibah and Mosul, co-operating closely with the Iraq Levies. The latter, recruited from Arabs, Kurds and Assyrians, and formed in 1916 as bodyguards for political officers in Iraq, were later taken over by the R.A.F. and enlarged into a force of keen and loyal Levy squadrons for security duties at R.A.F. stations. They were disbanded last month, but those who volunteer are to be absorbed into the Iraqi Army. Their tribal dancing, in costume, was for years a great feature of station entertainment.

Early in 1941, "all-out" war came briefly to Habbaniya. Following the Baghdad revolt by the Nazi-inspired politician Rashid Ali, over 9,000 Iraqi troops besieged Habbaniya; but within a month they were routed by a handful of non-operational aircraft (hastily organized from "Habb's" No. 4 Flying Training School, and given the grandiose title of the "Habbaniya Air Striking Force") with the assistance of British troops air-lifted in, R.A.F. bombers from other parts of the Middle East, No. 1 Armoured Car Company, R.A.F., and the Levies.

Ill-equipped for fighting, or long siege, and with women and children adding to his responsibilities, the A.O.C. deferred any

belligerent action against the besiegers until, following a message from the Prime Minister—"If you must strike, strike hard"—the Habbaniya Air Striking Force went into action at dawn on May 2nd, 1941—just 14 years to the day before Habbaniya was to become an Iraqi station. These aircraft, assisted by the bombers and by good work by the Levies (who sallied forth into the desert at night and wrought havoc among the rebel gun crews), at last proved too much for the besiegers, and one night they decamped. At dawn, R.A.F. aircraft and armoured cars, and British troops, were in full cry after them, eventually routing them and forcing Rashid Ali to flee.

In the earliest hours of the revolt the Regent, the Amir Abdul Illah—who was then running Iraq until young King Feisal should come of age—had fled to Habbaniya for protection, and was subsequently flown by the R.A.F. to Jordan. After the war he became a well-known figure at Habbaniya, visiting it several times.

Since the war the station has proved invaluable as a centre for promoting better understanding and closer military co-operation between the R.A.F. and the Royal Iraqi Air Force. Iraqi squadrons were trained at Habbaniya, and personnel of the two Air Forces worked together in close harmony. High standards of co-operation were achieved as their aircraft, first piston-engined, then jet-propelled, flew together on training operations. Habbaniya, too, proved ever ready to help its Iraqi friends in time of national disaster—as happened not long ago when the Tigris inundated Baghdad and the surrounding countryside, submerging the R.I.A.F.'s largest airfield. The A.O.C., Iraq, immediately invited the R.I.A.F. to live at and operate from Habbaniya until the floods subsided, and placed the full resources of the station at the Iraqi Government's disposal to help in flood relief work.

The handing over of Habbaniya inevitably means the disappearance from the R.A.F. scene of several unique aspects of day-to-day life not found elsewhere in the Service.

Habbaniya, for instance, housed the world's only mounted R.A.F. Police Detachment, maintained principally for night desert patrols against intruders, because horses could operate where even the many-purpose jeep could not. The R.A.F. "Mounties" formed a colourful adjunct to station life, and at parades and ceremonies injected a flash of pageantry not found on any other R.A.F. station.

One of the station's great recreational institutions was its Royal Exodus Hunt—the only R.A.F. Hunt in the world, and "Royal" because the Regent, its patron, granted it that prefix. Its magnificent pack of thoroughbred English foxhounds and its pink-coated riders—of both sexes—hunted jackal in the desert; and their Christmas morning gatherings for a stirrup cup before moving off to the hunt were a sight to be remembered.

Another pleasant feature of Habbaniya's recreational side was its well-appointed officers' club, a welcome social amenity when the nearest place for a dinner a little different, or for an evening's dancing, was Baghdad. At the club one might dine well on the lawn, or enjoy dinner-dances and other entertainment. No one who knew the club will ever forget the beauty of the setting, surrounded as he was by great trees, the heavy scent of flowers, and watched, from perches on the fairy-light wires surrounding the lawn, by a dozen or so little brown owls. Intermittently, the evening's stillness would be broken by the banshee wail of chorusing jackal.

So huge was Habbaniya that one usually taxied from point to point, using the station's own service of luxurious, American-style cabs at a controlled and reasonable price; and it was possible, too, to hire a fast car for the 100-mile return trip to Baghdad for as little as £2.

Habbaniya's racecourse, with its ponies and tote, was another popular feature of the station, where everything possible was done to defeat the boredom which, despite the amenities at their disposal, used inevitably to descend upon those serving there; for, although they lived amid the beauties of their desert garden, and enjoyed one of the highest standards of living imaginable in Service life, the lack of contact with the outside world was always difficult for many of Habbaniya's inhabitants to endure.

*Mounted on their Arab horses, three R.A.F. Police, of the only mounted R.A.F. police detachment in the world, move out from their headquarters to begin duty patrols.*

## Habbaniya's Famous Squadrons

Among the more famous R.A.F. squadrons to serve at Habbaniya at one time or another were Nos. 6, 30, 32, 55, 70 and 73 Squadrons.

*No. 6 Squadron's* Western Desert activities in the last war earned it the soubriquet of "the flying can-openers," owing to the fact that its Hurricanes were the first to be equipped with 40 mm cannon, which they used against enemy tanks with great success. No. 6 has been on operational service longer than any other R.A.F. squadron, and, of its 41 years' existence, 36 have been spent overseas. It is one of the few squadrons able to claim continued existence since inception. Formed in 1914, it flew on operations on the Continent, using a variety of aircraft ranging through B.E.2s, Bristol Scouts, Voisins and Blériots. It has been continually in the Middle East since 1918, has operated on a number of occasions from Habbaniya, and was there when the handing-over ceremony under the Anglo-Iraqi Agreement was held on May 2nd this year.

*No. 30 Squadron*, now of Transport Command, was formed in Egypt in 1915, moved to Mesopotamia later that year, and became engaged, in 1916, during the siege of Kut-al-Imara, in the first air transport support operation in the history of British flying, when its B.E.2Cs dropped food and supplies to the beleaguered British garrison. Over 30 years later it was to fly Dakotas in the Berlin Airlift. In the Second World War, No. 30 operated in the Western Desert, from Greek bases in defence of Athens, at Crete (where its aircrews and ground crews were engaged in heavy fighting), in Colombo, Ceylon, in 1942 (when it helped to counter the Japanese air attack there on Easter Sunday), and in Burma in 1944. Re-formed in 1947, it now operates between London and Warsaw, on V.I.P. and other transport commitments.

*No. 32 Squadron*, formed in 1916, fought throughout the First World War in Europe, and in 1916 its commanding officer, Major L. W. B. Rees, won the Victoria Cross for attacking ten German bombers single-handed. In 1942 the squadron went to North Africa, later moved to Italy, and in 1944 became a unit of the Balkan Air Force. In 1945 it went to Palestine for routine sector patrols, training, and Army Co-operation duties until the end of the war. In its long history it has been equipped with aircraft ranging from the de Havilland Scout with one Lewis gun to its present Venoms carrying four 20 mm cannon.

*No. 55 Squadron*, formed in 1916, first went to Iraq in 1921, and until 1923 took part in operations against the Turks. In 1938 it was based at Habbaniya, but in 1940, following Italy's entry into the war,

*(Left) Members of the Royal Exodus Hunt, and some of their thoroughbred English foxhounds, gather in the desert outside the station prior to moving off to hunt jackal. (Right) The Iraqi Levies, maintained by the R.A.F. in Iraq for station defence duties, were for years a colourful aspect of the life at Habbaniya. Here is seen a group of the Levies—Arabs, Kurds and Assyrians—in their native costume, in which, in off-duty hours, they would sing their tribal songs and dance their tribal dances.*

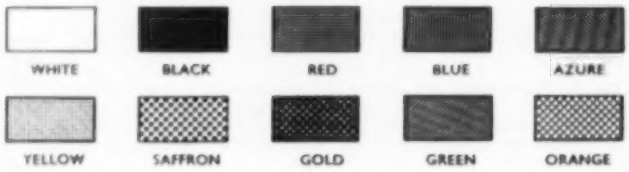
## FAREWELL TO "HABB" . . .

began a long association with North Africa, participating in operations against the German and Italian forces which included violent attacks by the squadron on Axis positions at El Alamein in 1942. The squadron subsequently participated in the invasion of Sicily, supported the Salerno bridgehead operations, and flew in many parts of the Middle East.

*No. 70 Squadron* this year celebrates its 39th anniversary as a member of the R.F.C. and the R.A.F. and its 35th year of unbroken service in the Middle East. Formed in 1916, it has been successively a fighter-reconnaissance, fighter, bomber and bomber-transport squadron. Maj. Tedder, now Marshal of the Royal Air Force Lord Tedder, was its second commanding officer during the First World War. In 1920 the squadron began its long association with the Middle East. It served at Hinaidi, Iraq, near Baghdad, from 1922 to 1927; and in 1929, flying Victorias, it carried out the first civilian evacuation by air ever made, flying civilians out of Kabul, Afghanistan, during the troubles there with King Ammanullah. In the Second World War its Liberators, Lancasters and Wellingtons served from the Western Desert to Italy on transport and many bombing operations. In 1949, in Exercise Grain Fare, No. 70 dropped food to starving tribesmen and women in the forbidding mountains of the Hadhramaut ("The Death") near Aden. During the 1951-52 troubles in Egypt, it played a large part in flying in troops, stores and equipment to the Canal Zone from other parts of the Middle East.

*No. 73 Squadron*—among whose members was F/O. "Cobber" Kain, D.F.C., one of the most famous pilots of World War II—was formed in 1917 and served in Europe until the end of the 1914-18 war, often in close support of the Tank Corps. Its Second World War service began on the Western Front, but later, in covering General Wavell's retreat at Tobruk, it fought until its last aircraft was destroyed in action, and itself destroyed 50 enemy aircraft in a fortnight's fighting. In 1942, as a night-fighter squadron, it took part in the Battle of El Alamein. In April 1945, after spending 16 months in the Italian campaign, it joined the Balkan Air Force in Yugoslavia in a fighter-bomber rôle. On May 2nd, 1955, during the ceremony at Habbaniya of handing over the R.A.F. base to the Iraqi Government, No. 73 Squadron Venoms flew past on their departure from the station, as part of the first phase of the R.A.F.'s withdrawal.

# MORE ABOUT INSIGNIA




SINCE we published, in our Military Aviation Special Number (May 13th) a five-page feature illustrating insignia of the world's air forces, it has been revealed that Bulgaria, Hungary and Rumania are using variations of the U.S.S.R. red star. Bulgaria's star has a white fimbriation, or edging, with a green disc surrounded by a white ring in the centre. There is a small red spot in the middle of the green disc.

A white ring appears in Hungary's red star, which is fimbriated yellow; Rumania's star is also fimbriated yellow, but the centre is blue. All these countries have their star repeated in the fin and the fuselage tail.

Viet-Nam has notified her national marking as an orange disc with three concentric circles, very narrow, in red, and the fin flash as an orange band with three red lines running across it.

South Korea has a device, based on a Mongolian charm against evil, in red and blue flanked by "compartments" like those found in U.S.A. insignia, while a large black letter K adorns the fin.

Perhaps the newest of all the insignia is that of Rhodesia, who have superimposed over the British roundels the three assegais from their threepenny piece.

Up to the present, it is believed, there has been no complete book of national and civil airline insignia, but next July Harraps will be publishing such a work in colour. It has been compiled and illustrated by Harold B. Pereira, with a foreword by Lord Douglas of Kirtleside.

We may appropriately add here certain miscellaneous information as addenda to matter published in the above-mentioned special number.

A Danish correspondent informs us that the F-84E is no longer in use in the Royal Danish Air Force; only four were delivered and those are now used for technical training. The Mustang, it seems, has never been actively employed; those acquired were scrapped "because of the spares problem." Miscellaneous types in service are Catalinas, Dakotas, Bell 47Ds, Firefly T.T.1s, KZ-VIIs and a few remaining Spitfire 9s and 11s. The sole Boeing B-17, formerly used for survey work, has now been sold to France. Most of the main airfields have now been completed up to NATO standard.

The same correspondent points out that the Colombian Air Force has at least one DC-4, formerly the S.A.S. machine OY-DFY, taken over in March last year. It is used as a V.I.P. transport for the President.

The Finnish Valmet Viima and Vihuri are, of course, of Finnish and not of Swedish origin.

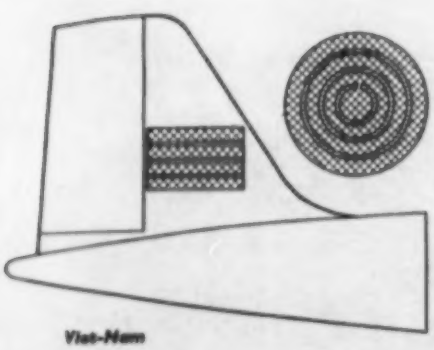
Another item of information is that the Saudi Arabian Air Force has ten Temco Buckaroo trainers.

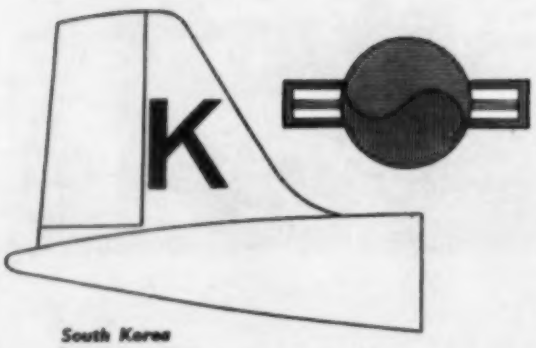
Bulgaria

Hungary

Rumania

Rhodesia and Nyasaland


Viet-Nam



South Korea

FLIGHT,
3 June
1955

# The fresh outlook on military pilot basic training

## THE ATTRIBUTES OF THE JET PROVOST INCLUDE . . .

| | |
|---|---|
| *Side by side seating* | The proven superior arrangement for all stages of flying training. |
| *Docile handling* | Essential in the early stages of a pupil pilot's training, and desirable thereafter. |
| *Slow approach and short landing* | To give the pupil pilot confidence and to permit the continued use of existing training airfields. |
| *Economy of operation* | Jet techniques are taught from the start thus obviating the need for so doing in the expensive advanced trainer. |
| *Easy Maintenance* | To make possible the high utilisation required in a flying training organisation. |

- The high cost and complexity of modern operational military aircraft make the choice of basic training methods of the utmost importance.
- It is logical that the pilots of an all jet air force should be trained primarily on a safe, economic, yet characteristic jet aircraft.

# Jet Provost

*Powered by one Armstrong Siddeley Viper Turbo-jet*

*Designed and manufactured by*

## HUNTING PERCIVAL AIRCRAFT LTD

*A Hunting Group Company*

LUTON, BEDFORDSHIRE, ENGLAND and at 1450, O'CONNOR DRIVE, TORONTO, CANADA

AP/128/109

French Aero Show
Le Bourget - June 10th - 19th
Aero Research Limited
Stand No. 161
Vous serez là? - Épatant!

'Redux' is used extensively for metal-to-metal bonding in the Fokker Friendship. Throughout this aircraft, particularly in the construction of the laminated spars and wings, 'Redux' shows what can be accomplished by the bold and imaginative use of adhesive bonding.

Years of investigation of many types of adhesives including a comprehensive series of static and fatigue tests at the N.L.L., Amsterdam, preceded the decision to use 'Redux'. Ten years have elapsed since this adhesive first contributed to new concepts of load-bearing structures; in that time it has been employed in fifty different types of aircraft, from airliners to guided missiles often operating under extreme climatic conditions. *Always* it has saved weight, simplified design, lowered costs and helped to solve problems of fatigue.

BONDS OF

'FRIENDSHIP'

There is a wealth of literature on the 'Redux' bonding process, much of it of significance to the designer and production engineers concerned with structures of the future. May we send you some examples?

*'Redux'* ADHESIVES *for metal aircraft structures*

*'Redux' is a registered trade name*

**Aero Research Limited** *Duxford, Cambridge. Telephone: Sawston 187.*

AP 264/142

# LOCKHEED v. DOUGLAS

## *A Brief Comparative Analysis of America's New Long-range Liners*

WE suggested in our issue of November 5th last that the next generation of long-range airliners would be dominated by the Bristol Britannia and the various developments of the Douglas DC-7. The great British turboprop liner is developing very satisfactorily, and it is not proposed to refer to it again here; but a new entrant has joined the race for global traffic, in the form of a Super-Super Constellation, the Lockheed L-1649. We now propose to draw a comparison between this remarkable design and its similarly powered competitor, the DC-7C or Seven Seas.

Incidentally, both types have been ordered in quantity, and so each can be considered as a definite type to be reckoned with. Again, both represent the policy of "stretching" of a basic design carried to what must be the ultimate degree. Both are powered by four Wright R-3350EA-2 Turbo-Compounds, giving 3,400 h.p. each up to 4,000ft and having a normal rated output of 2,800 b.h.p. to 4,300ft. Both L-1649 and DC-7C also have re-worked airframes, with a revised tail assembly of rather greater area, and —more important—a new wing of longer span. These new wings have higher aspect ratio, so induced drag figures are improved, and specific range likewise. The greater wing area is needed to counteract the increased take-off weight; and the latter results largely from the immense tankages which the two new transports can put into the extra space available inside the wing. Finally, most of the added span of both types has been inserted in the centre section, so that the inboard engines are further out and the interior noise level is better than before.

The new Lockheed, in particular, has a wholly new wing. The section is slimmer, the t/c ratio having been reduced from 18 to 15 per cent. The opportunity has also been taken to effect structural improvements, and integrally stiffened skin is now used from root to tip on both lower and upper surfaces (previously only the underside was so made). The chordwise spread of this integrally stiffened wing box is greater than before, so making space available for no less than 9,600 U.S. gallons. The tankage is entirely integral, all fuel lines being inside the tanks themselves. Other features of the 1649 are a new hydraulic system working at 3,000 lb/sq in, divided into two independent systems in parallel; a new and simplified twin-booster flying-control system; a wholly new flap system, with steel torque tubes driven by dual hydraulic motors and screwing the flaps out on steel tracks; complete re-arrangement of the interior (which is again "styled by Henry Dreyfuss") and heating of the lower freight holds to above 32 deg F at an outside air temperature of −20 deg F.

Lockheeds have now worked out the performance of the 1649A as accurately as they can at this stage, and they have compared it with the estimated figures for the DC-7C. Some of the results are given here, and we wish to stress that the figures are those assumed by Lockheed. The DC-7C performance does not, however, differ materially from that put out by Douglas, and so can be accepted as accurate. In any case, no aircraft manufacturer would deliberately falsify figures for a competitor's product; the airlines who are in the market for aircraft of this nature do their own calculations.

The outstanding characteristics of both the new transports are the following: extreme range, either with maximum or reduced payload; block speeds only slightly better than those achieved

*A three-view drawing of the Lockheed L-1649A with the shaded silhouette of the L-1049G Super Constellation in the plan view. Standard engine for both aircraft is the Wright Turbo-Compound.*

with current equipment; a range of cruising altitudes "in the weather"; competitive direct operating costs; and a relatively low maximum payload, either reckoned on space- or weight-limitation. These are, in fact, all the hall-marks of a highly stretched design. If Lockheed and Douglas had started from scratch, using turboprop power, there is no doubt that they could have overcome their present deficiency in cruising speed, cruising altitude and maximum payload.

Reference to the curves of payload/range and range/block speed indicate (say Lockheed) the following results. In standard (62-passenger) form, the DC-7C will carry a payload of 17,050 lb a distance (still-air, not an airline stage) of 4,010 statute miles. The 1649A will carry the same load a distance of 4,620 miles. The standard-configuration space payload of the DC-7C (17,550 lb) can be carried 3,580 miles at maximum cruising power. To increase the distance, it is necessary to adopt l-r cruise procedure

**BASIC COST ASSUMPTIONS ($1,000 = £357)**

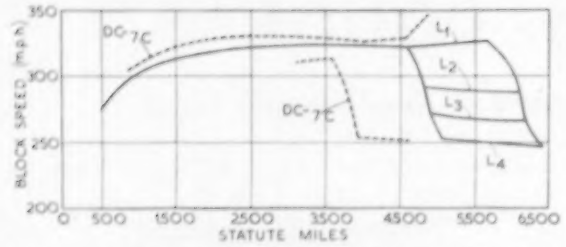
| | DC-7C | 1649A |
|---|---|---|
| Basic price | $2,205,539 | $2,295,000 |
| C.F.E. | $40,000 | $40,000 |
| Galley | — | $15,000 |
| Changes (based on experience) | $30,000 | $30,000 |
| Radar | $20,000 | $20,000 |
| Total | $2,295,539 | $2,400,000 |
| Cost per engine | $79,800 | $79,800 |
| Cost per airscrew | $13,700 | $22,500 |
| Cost of radio | $45,000 | $45,000 |
| Cost of airframe | $1,876,539 | $1,945,800 |
| | $1,976,339 | $2,080,800 |
| Weight empty | 73,238 lb | 85,752 lb |
| Engine weight | 3,609 lb | 3,609 lb |
| W.E., less engines | 58,802 lb | 71,316 lb |
| Gross weight | 139,000 lb | 156,000 lb |

**OPERATING WEIGHT DETERMINATION**

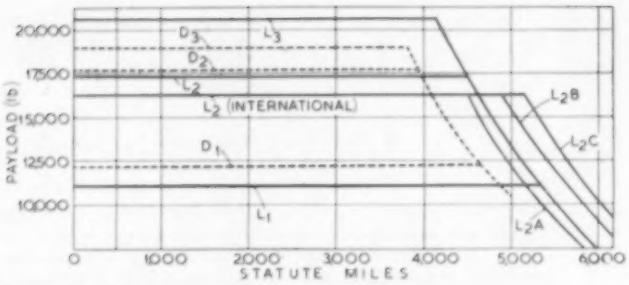
| | L-1649A 63 seats | L-1649A 87 seats | DC-7C 62 seats | DC-7C 87 seats |
|---|---|---|---|---|
| Basic empty weight | 87,413 | 87,413 | 75,001 | 75,001 |
| Interior correction | +1,058 | 0 | 0 | −309 |
| Empty weight | 88,471 | 87,413 | 75,001 | 74,690 |
| Operating equipment: | | | | |
| Crew and baggage | 1,786 | 1,786 | 1,786 | 1,786 |
| Life rafts | 529 | 661 | 529 | 661 |
| Life vests | 154 | 198 | 154 | 198 |
| Emergency radio | 33 | 33 | 33 | 33 |
| Food, water, etc. | 1,653 | 1,918 | 1,653 | 1,918 |
| Consumable oil | 1,741 | 1,741 | 1,741 | 1,741 |
| Spares | 88 | 88 | 88 | 88 |
| Total equipment weight | 6,041 | 6,495 | 6,041 | 6,495 |
| Operating empty weight | 94,569 | 93,908 | 81,042 | 81,185 |
| Space payload | 11,111 | 17,053 | 17,550 | 18,971* |
| Zero-fuel weight | 105,680 | 110,961 | 98,592 | 100,156 |

* Limited by maximum landing weight.

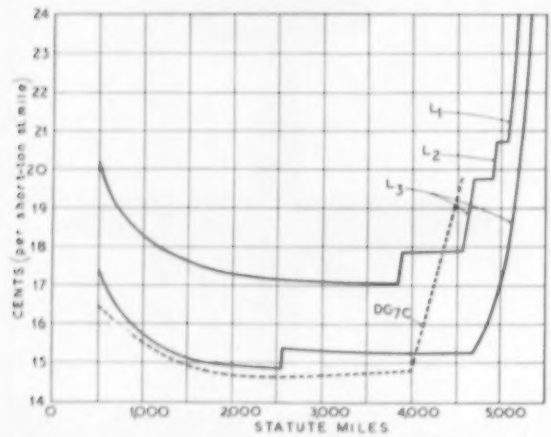
## LOCKHEED v. DOUGLAS . . .



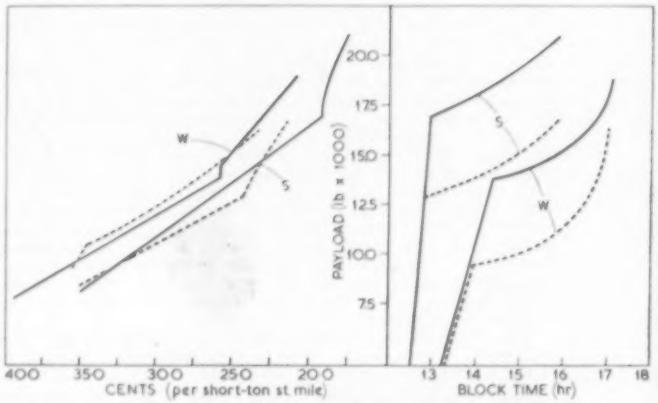

*Block speed: flight distance. $L_1$=max. cruise (21,800ft), $L_2$=l-r cruise (20,000ft), $L_3$=l-r (15,000ft), $L_4$=l-r (10,000ft); upper broken line, Douglas curve, and lower, Lockheed curve for DC-7C (62-seater).*




*Payload: flight distance $L_1$=32-seat Lockheed, $D_1$=32-seat Douglas; $L_2$, $D_2$=62-seat ($L_2A$, B, C=max. cruise at 21,800ft, and l-r cruise at 15,000 and 10,000ft); $L_3$, $D_3$=87-seat. DC-7C has broken lines.*




*D.O.C.: flight distance. Upper full curve is international L-1649A ($L_1$=l-r cruise at 10,000ft, $L_2$=l-r at 15,000ft and $L_3$=max. cruise at 21,800ft); lower, domestic, and broken curve is Douglas plot for DC-7C.*




*Payload: block time and D.O.C. for Paris-to-New York. Full lines, Lockheed L-1649A, and broken line, DC-7C (Lockheed curves). Letters "W" and "S", winter and summer operation, assuming 75 per cent winds.*

and lose altitude. Thus, if the cruise height is reduced to 10,000ft the range can be raised to 3,950 miles, but at the expense of lowering the block speed from 314 to 258 m.p.h. Yet, the 1649A is claimed to offer full space payload (17,100 lb) up to 4,130 miles at maximum cruise power, resulting in a block speed of 315 m.p.h.

In tourist configuration (87 passengers) the Seven Seas should take 18,950 lb for 3,750 miles; to accomplish this, say Lockheed, it needs l-r cruise power at 10,000ft, achieving a block speed no greater than 253 m.p.h. The big Lockheed, however, is promised to lift the same load 4,300 miles at maximum cruise power, making possible a 316 m.p.h. block speed.

These advantages become more marked when applied to specific routes. Taking the North Atlantic as the obvious case, Lockheed have prepared a regularity table for both transports, operating a year-round non-stop service between Paris and New York. The superiority of the L-1649A is marked; and T.W.A. are to use it on this route. The curves, based on tourist configuration for the same route, are claimed to show that, with the same payload, the 1649A is 2 hr 54 min faster than the Seven Seas against summer winds, and is eight per cent cheaper on D.O.C., and is likewise 2 hr 21 min faster against winter winds and is then five per cent cheaper. On a load basis, the Lockheed is claimed to take 3,950 lb more payload when cruising at DC-7C speed in summer, and can then be operated 21 per cent cheaper; or, against winter winds, the advantage is 4,200 lb, and 27 per cent on D.O.C.

**NORTH ATLANTIC REGULARITY EXPRESSED IN PERCENTAGES**

| Altitude | Cruise control | 32-passenger De Luxe | | | 62-passenger Standard | | | 87-passenger Tourist | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1649A | DC-7C | 1649A Adv. | 1649A | DC-7C | 1649A Adv. | 1649A | DC-7C | 1649A Adv. |
| Summer | | | | | | | | | | |
| 21,800 | M.C. | 99 | 63 | +36 | 73 | 0 | +73 | 6 | 0 | +6 |
| 21,800 | L.R.C. | 99 | 82 | +17 | 89 | +5 | +84 | 20 | 0 | +20 |
| 15,000 | L.R.C. | 99 | 99 | 0 | 99 | 33 | +66 | 46 | 6 | +40 |
| 10,000 | L.R.C. | 99 | 99 | 0 | 99 | 62 | +37 | 80 | 15 | +65 |
| Winter | | | | | | | | | | |
| 21,800 | M.C. | 88 | 22 | +66 | 29 | 0 | +29 | 1 | 0 | +1 |
| 21,800 | L.R.C. | 93 | 37 | +56 | 47 | 1 | +46 | 5 | 0 | +5 |
| 15,000 | L.R.C. | 99 | 70 | +29 | 70 | 12 | +58 | 17 | 1 | +16 |
| 10,000 | L.R.C. | 99 | 88 | +11 | 92 | 27 | +65 | 42 | 7 | +35 |

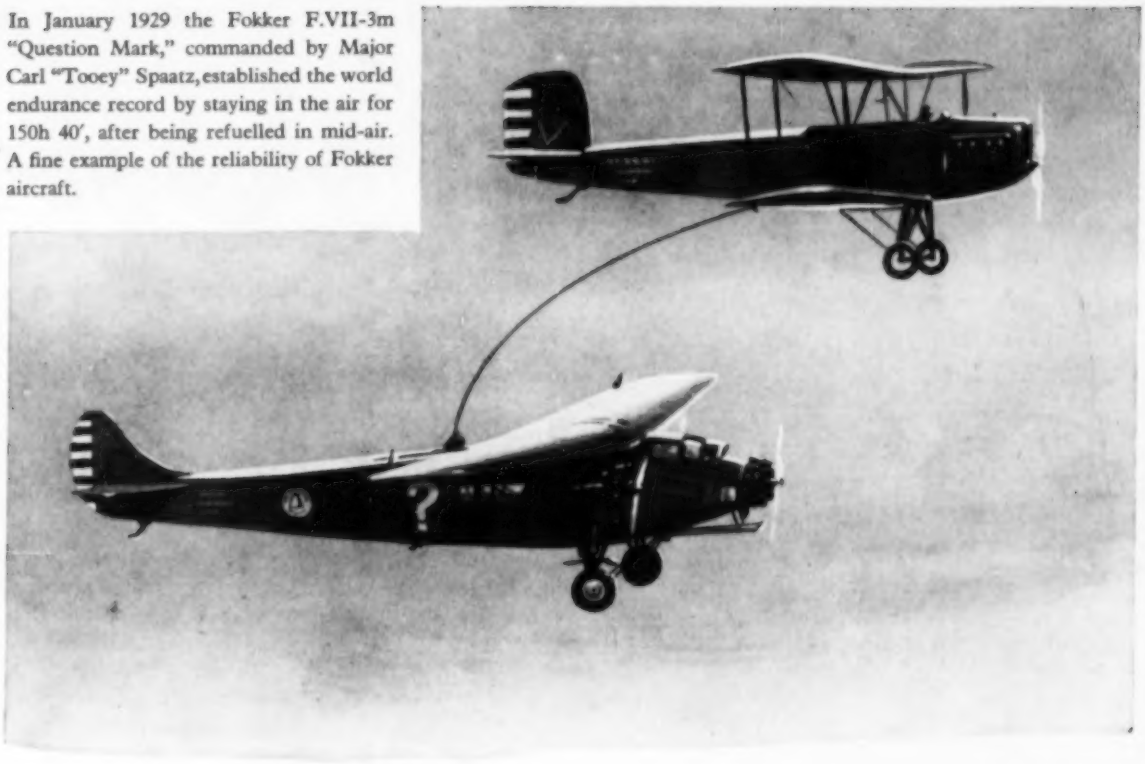
**DOLLARS PER HOUR OPERATING COST (DIRECT)**

| | DC-7C | 1649A |
|---|---|---|
| Annual costs | $146.6 | $153.0 |
| Depreciation: Aircraft | 75.7 | 78.6 |
| Engines | 12.9 | 12.9 |
| Airscrews | 2.2 | 3.6 |
| Radio | 2.1 | 2.1 |
| Aircraft spares | 9.6 | 10.1 |
| Engine spares | 9.7 | 9.7 |
| Insurance | 34.4 | 36.0 |
| Fixed hourly costs | $159.9 | $164.9 |
| Labour: Aircraft and miscellaneous | 24.9 | 28.9 |
| Engines | 13.0 | 13.0 |
| Material: Aircraft and miscellaneous | 20.0 | 21.0 |
| Engines | 37.0 | 37.0 |
| Crew cost | 65.0 | 65.0 |
| Costs varying with distance | | |
| Fuel and oil | 0.0446 F/Tb | 0.0446 F/Tb |

Total cost for DC-7C = 0.0446 F/Tb + 306.5
for 1649A = 0.0446 F/Tb + 317.9
where F = lb fuel burnt and Tb = hr block time.

The operating-weight determination is shown in the tables of weight breakdowns. The space payloads were reckoned on the basis of 154 lb per passenger, with a baggage allowance of (standard) 59 lb stowed and 6.6 lb in the cabin and (tourist) 48 lb stowed and 6.6 lb in the cabin. Baggage was taken to weigh 14 lb/cu ft and freight to be 10 lb/cu ft. Operating assumptions include the following for both transports: manœuvre time, sum of approach and landing (10 min), take-off (1 min), taxi (10 min) and run-up (5 min), totalling 26 min, or 83.2 Imp. gal; reserve fuel was assessed at 200 nautical miles distance to an alternate, 2 hr holding using l-r cruise at 10,000ft, cabin heating using 300 lb fuel and route reserve five per cent of block fuel. We would also stress the obvious fact that Lockheeds have used the A.T.A. method throughout for calculating D.O.C.s, and not the more realistic S.B.A.C. method.

In January 1929 the Fokker F.VII-3m "Question Mark," commanded by Major Carl "Tooey" Spaatz, established the world endurance record by staying in the air for 150h 40', after being refuelled in mid-air. A fine example of the reliability of Fokker aircraft.

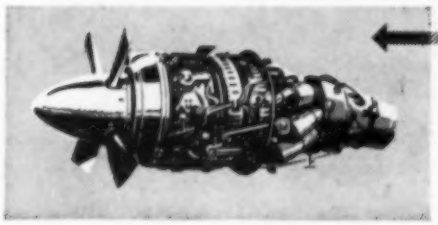


PIONEERS IN THE PAST — Fokker — PIONEERS IN THE FUTURE

## FOKKER WILL SPAN THE WORLD AGAIN!

**THE NEW FOKKER F. 27 "FRIENDSHIP"**

twin-turboprop airliner for 28-36 passengers in which more than 35 years of experience in commercial aviation is incorporated, is the most suitable transport for short to medium range traffic available, meeting both ICAO and CAR4b requirements.



**THE ROLLS-ROYCE "DART" TURBOPROPS**

With which the "Friendship" is powered are the most reliable propeller-turbines available for this type of aircraft. They allow economical operation at all climates and safe and vibrationless flight at 20,000ft.

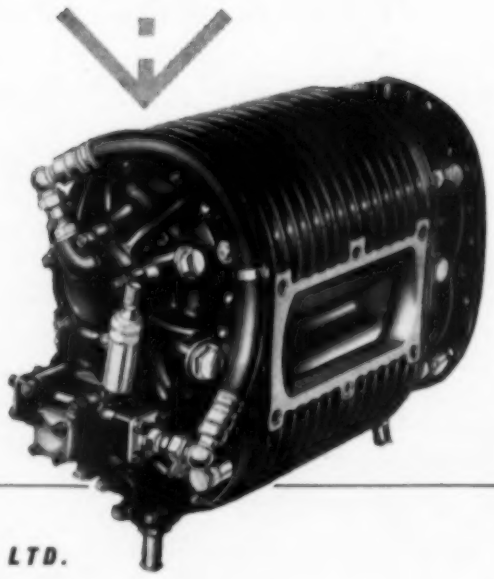
* * *

**ROYAL NETHERLANDS AIRCRAFT FACTORIES FOKKER**

SCHIPHOL-ZUID TEL. ADDR.: FOKPLANES-AMSTERDAM

# Pressurizing the 'Friendship'

*Type 15 Cabin Superchargers have been chosen for the Fokker 'Friendship'*



GODFREY
SIR GEORGE GODFREY & PARTNERS LTD

**SIR GEORGE GODFREY & PARTNERS LTD.**

HANWORTH, MIDDLESEX HENLEY, OXFORDSHIRE

OVERSEAS COMPANIES: MONTREAL, JOHANNESBURG & MELBOURNE

# RUMBOLD

## FOKKER "FRIENDSHIP" SEATS

The seats provided in the Fokker "Friendship" are supplied by Rumbolds of London and are a specially designed development resulting from technical co-operation between Messrs. Fokker and Rumbolds.

* * *

The seat is a double fixed-back type of simple and sturdy construction. It gives complete support, relaxation and comfort.

* * *

The seat is fully approved 9G fore or aft facing. Weight approximately 36 lbs.

L. A. RUMBOLD & CO. LTD., KILBURN, LONDON, N.W.6.

*Telephone:* MAlda Vale 7366-7-8

*The Fokker F.27 "Friendship"*

ROTOL

PROPELLERS AND
ACCESSORY DRIVE
EQUIPMENT

# Louis Bréguet's Work—an Appreciation

**AS we said in a brief obituary on May 13th, the death of Louis Bréguet deprives aviation of almost the last of the great figures of the pioneer flying days in France. Some of his many technical achievements are recalled in the present article by an aeronautical engineer who has made a close study of his work.**

THE Richet mentioned in connection with the early Bréguet experiments was the late Professor Charles Richet, member of the French Academy, an eminent scientist of that period. He, Louis and Jacques Bréguet worked, from 1905 onwards, on aerodynamic research directed towards the development of helicopters styled "gyroplanes."

The 1907 design, a pure helicopter without provision for horizontal flight, was the first of its kind to rise from the ground with a pilot on board, and it proved capable of keeping in the air for periods of minutes (August 24th, 1907). Its total weight was 1,200 lb and the Antoinette engine developed about 45 b.h.p. The second and the third gyroplanes were the first aeroplane-helicopter combinations ever tried full-scale. The second succeeded in making a few short horizontal flights of up to 30ft altitude (July 22nd, 1908), but this and the third gyroplane were abandoned in favour of a fixed-wing aeroplane, partly owing to lack of funds and partly because of the unreliability of the engines of that period.

The first design, a 1909 tractor biplane, with tail booms, much metal construction, and air/hydraulic shock-absorbers in the undercarriage, met with little success and was damaged. A complete redesign, with fuselage, led to a truly remarkable type which was to be typical of Bréguet design for years to come. It was a clever attempt to attain high aerodynamic efficiency and good stability. The wing system showed most carefully shaped aerofoil sections (mathematically developed by Bréguet), combined with a high aspect-ratio (up to 9.4); a wide gap between the single-spar, steel-tube wings; single struts; much-reduced bracing (by steel cables); and elastic spring-loading of the spars to relieve gust loads and to produce automatic wing-warping in turning flight. Original, too, was the modern control layout, with a wheel on top of a control column, and throttle control by pedal.

Biplanes of this type flew till 1915 and, like most other Bréguet aeroplanes, were typical of all that was good in French construction, exhibiting careful attention to details and very good workmanship. Many of these early biplanes were sold abroad; some reached this country and also Germany, where the type gave impetus to the development of the tractor biplane after having proved superior to all German types then in existence.

With the earliest version of these biplanes Louis Bréguet secured pilot's ticket No. 52, on April 10th, 1910. On a later type, in 1911, with 100 h.p. Gnome, he carried 11 youthful passengers—a total load of 1,400 lb. Normally this type was a military three-seater, with one observer facing aft. The early versions had geared airscrews, with articulated metal blades of self-adjusting pitch; these were later discarded in favour of lighter wooden propellers. The three-wheel undercarriages were steerable and possessed brake skids.

Engines of between 60 and 200 h.p. were installed. Completely enclosed engines appeared for the first time, and radiators forming part of the wing were introduced, too. Several of these pre-1914 Bréguet biplane designs were floatplanes, generally with a central large float with elastic mounting. Most of the biplanes had wing-warping, but of a kind which did not strain the rib structure, since the entire wing rotated about its tubular spar. All of them had cruciform control surfaces (rudder and elevator combined) with universal mounting at the rear of the fuselage. Welding was extensively employed, and few if any of these biplanes suffered from serious structural insufficiency.

In 1913-14, it is believed, the Bréguet works also constructed a series of modified Bristol biplanes. The experimental 200 b.h.p. tandem flying-boat *La Marseillaise*, which had sponsons for water stability, met with little success. During the 1914-18 period, Louis Bréguet's name was connected with three notable designs. The Bréguet-Michelin pusher biplane, mostly of metal, of which about a hundred were constructed, was the outcome of a fierce competition in 1915. In 1916-17 Bréguet collaborated with Eiffel in the design of an interesting strut-braced, low-wing monoplane of very modern appearance—which, however, came prematurely to grief. The Bréguet XIV multi-purpose two-seater biplane of 1916-17 proved an unqualified success. It had variable-camber flaps with gust relief; and one version, in 1917, could be claimed as the first flying ambulance ever built and operated.

A post-war 1,000 h.p. four-engined biplane ("Leviathan") met with no success, in spite of an ingenious automatic coupling arrangement; and an attempt to develop aero-engines also proved abortive. But, by contrast, the Bréguet XIX multi-purpose military biplane of 1921 was highly successful. One of the first metal aircraft ever produced in substantial quantities, it was followed by the Bréguet 27 and 41 all-steel biplanes, all three being for military purposes. Actually, however, Louis Bréguet has always been sincerely interested in the development of commercial transport aircraft, and his papers read in this country before the R.Ae.S. are among classics on the subject.

Like Sikorsky, Louis Bréguet returned to his first love, the helicopter, and the Bréguet-Dorand experimentation of 1935 came close to triumph indeed. This venture employed two co-axial rotors of two blades each, again using the principle of self-adjustment of the blades to which Bréguet had been partial from the beginning. The blades had universal joints and were freely flapping. Some very promising flights and circuits were demonstrated on about 240 b.h.p., though the machine weighed over two tons. Development was discontinued on account of the nationalization of the firm (a process which was to ruin the prospects of French aeronautical engineering for years to come).

Louis Bréguet has also become known as the author of notable scientific treatises and of valuable technical papers. During his early work on commercial aircraft development, he established formulæ for aircraft range and endurance which are now well known under his name. A son-in-law of his became successively Prime Minister and Air Minister—in which connection Bréguet's name was occasionally accorded unwanted publicity.

A.R.W.

## FOKKER FRIENDSHIP (continued from page 767)

supplied by Godfreys, and a duct relief valve and a double-flap non-return valve by Normalair are also included.

The use of a turbo-compressor type of cold-air unit has been put forward for the proposed cabin air-conditioning installation. The cooler and as much associated equipment as possible would be located behind the rear pressure bulkhead.

Pneumatics are responsible for the retraction and locking of the undercarriage, nosewheel steering mechanism, and brake operation. There are mechanically operated emergency systems for undercarriage and brakes, and a mechanically operated parking brake. Air bottles and other pneumatic equipment are installed behind the rear cockpit bulkhead, on the port side.

Electrical de-icing is being provided for the airscrews, engine air intakes, pitot heads, windscreens, and possibly additional air intakes. Fokker's originally proposed thermal anti-icing scheme for wing and tail leading-edges is undergoing further consideration in view of the more stringent requirements for aircraft de-icing now being introduced by the American C.A.A.

The electrical installation consists of (a) a 28-volt D.C. system, incorporating an engine-driven generator on each engine, and a 24-volt battery, and (b) an A.C. system using 115-volt, 400-cycle main and auxiliary inverters run off the normal aircraft D.C. supply, and two engine-driven alternators giving 208 volts, 400 cycles.

### PROTOTYPES AND TESTS

The first machine, now nearing completion, will be used as a flying prototype to study the basic performance and handling characteristics of the type. As mentioned, it will be fitted with neither pressurization nor anti-icing, and will have Dart 507s. The second complete airframe will be used for fatigue testing (the fuselage being tested in Fokker's recently built concrete water-tank at Schiphol). The third machine, complete with Dart 511s, pressurization, de-icing, and full furnishings, will act as a second flying prototype (at which time the first will be re-engined with 511s and completely equipped before resuming flying); and the fourth will be used for static testing. Subsequent machines will form the production series. The first production aircraft should fly about the middle of 1957, and the initial batch of 20 should be completed in about 18 months.

In addition to having been designed to obtain a Dutch certificate of airworthiness the F.27 is being so constructed that, with minor modifications, it will comply with the American Civil Air Regulations. The probability is strong that the Fairchild company will take up its option on the right of American manufacture of the F.27.

Apart from the fatigue tests, the static tests to be performed on the Friendship at Schiphol include water-tank testing of the pressure cabin to twice the normal working pressure; combined tests of fuselage under ultimate in-flight bending loads without pressurization and at one-and-a-half times working pressure; ultimate landing load on centre-section and fuselage (critical for torsion and shear of centre-section, wing-fuselage attachment and bending of rear fuselage); and ultimate bending load of wing.

# SOLDERING ALUMINIUM

## *A New Process Approved by the M.o.S. for Aircraft*

DETAILS of the development of what are claimed to be the first solders approved by the Ministry of Supply for joining aluminium and aluminium alloys have recently been released by the Sheffield Smelting Co., Ltd., whose laboratories have evolved what is known as the Thesscal process.

Research was directed towards attaining a satisfactory medium between soft soldering at around 250 deg C and brazing at about 600 deg C. On light alloys, the former process usually results in a low-strength joint with poor corrosion resistance, while the latter involves temperatures too high for joining thin-gauge sheet of the strong age-hardenable materials such as Duralumin, and introduces risk of distortion.

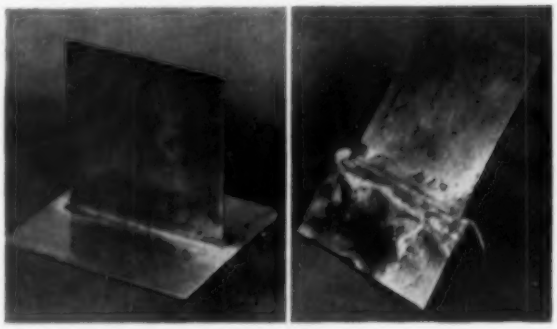
Extensive tests of the process were carried out by the R.A.E. prior to the granting of M.o.S. approval; humidity tests lasting nine months were made by the Radar Research Establishment, Malvern; and the Metropolitan Vickers Electrical Co., Ltd., Rolls-Royce, Ltd., various airframe manufacturers and the Aluminium Development Association have also co-operated. Trials have included salt-spray tests of joints and two-year exposure to Sheffield's industrial atmosphere. A series of British and foreign patent applications has been made.

The work resulted in the production of two hard solders, Thesscal "A2" and "P.12," which have been approved to specifications D.T.D. 900/4367 and D.T.D. 900/4398 respectively.

"A" has a melting range of 420 deg C to 450 deg C and is used with the maker's No. 92 flux. Main application is on sheet metal and fabricated forms of aluminium and its alloys. This is a free-running solder, and the technique of use is very similar to that of silver soldering. "P.12" hard solder has a wider melting range, namely, 440 deg C to 510 deg C. Not so free-running as Thesscal "A," it can be moulded rather in the manner of plumbers' solder. Its use is principally in aluminium alloy castings—to repair broken castings, build up lugs and protrusions, join castings to sheet metal, and to fill in blowholes or incorrectly positioned drill holes. Like the other, it is used with No. 92 flux.

Thesscal "A" is stated to have particular application for aircraft equipment, and for unstressed or lightly stressed parts, in situations where the low process-temperature enables thin Duralumin sheet or sections to be joined by unskilled labour without danger of fusion. One manufacturer has used the process for assembling elevator tips from light-gauge Alclad, thus effecting a weight-saving in comparison with the welded assembly in heavier-gauge material previously used.

Weight-saving, it is pointed out, can also be effected by re-design of assemblies in the light of the fact that Thesscal will not only join a wide range of aluminium alloys one to another, but will unite any of them to copper, brass, phosphor-bronze, Tungum, gunmetal, nickel, nickel silver, steel, and stainless steel.



*A Duralumin-to-aluminium test joint in 16 s.w.g. sheet. After hammering, the aluminium has cracked but the joint-line is unaffected.*

Application is a straightforward matter of heating with a brazing torch. Two considerations, however, have to be taken into account. The first is that, as in many silver-soldering processes, the flux is corrosive and must be washed off the joint. The Thesscal flux, however, has the advantage of being quickly soluble in hot water. The second consideration is that Thesscal-soldered joints cannot be anodised, because they are attacked chemically by the solution; but this difficulty can be overcome by using proprietary stop-off lacquers before anodising. Where some form of protection of the whole assembly is called for by specification, etching primers and paints can be used quite successfully; this alternative method is approved by the M.o.S.

Thesscal "A" solder, in the "as cast" condition, is stated to have the following properties: yield point, 8.4 tons/sq in; U.T.S., 9.4 tons/sq in; elongation, 5 per cent; electrical conductivity, 22.3 per cent I.A.C.S. Detailed technical data, including results of destruction and other tests on joints, are obtainable from the Sheffield Smelting Co., Ltd., Royds Mill Street, Sheffield 4.

---

## CANADIAN HUNTING APPOINTMENTS

SOME recent appointments in three Hunting Group companies in Canada have been announced. Mr. Fred M. Hanna has joined Hunting Associates, Ltd., as technical assistant to Mr. D. N. Kendall, vice-president. He will assist Mr. Kendall in the establishment of technical policy in all companies in the group. Mr. Hanna's previous appointment was as chief engineer of P.S.C. Applied Research, Ltd., one of the Hunting Associates companies. He is closely associated with this company's development of airborne magnetometers and radiation detectors.

Mr. George Suarez has been appointed general manager of Field Aviation Co., Ltd., Oshawa, Ontario. Formerly manager of the survey-flying division of the Photographic Survey Corporation and Kenting Aviation, Ltd., Mr. Suarez has been with P.S.C. since 1947.

One of Canada's most experienced helicopter pilots, Mr. Al Soutar has become manager of Kenting Aviation, Ltd. He has been closely connected with the group's aircraft operations since he joined the Photographic Survey Corporation, the first Hunting company in Canada, on its formation in May, 1946.

## STORING DRAWINGS

FROM Randalrak, Ltd., 106 Victoria Street, London, S.W.1, come details of a storage system for engineering and other drawings—in fact, any such document that can be rolled—that appears to combine the advantages of maximum space-economy and minimum time-expenditure in locating a particular drawing.

These "Planstore" units consist of a number of compartments each housing a rectangular plastic socket, one end of which is closed by two inclined surfaces terminating in a lug handle. Both surfaces incorporate a reference-label holder and the angle of presentation permits easy reading at any height. A drawing is rolled and one end inserted into the socket, which grips the document flexibly yet firmly. The other end is then introduced into the compartment and the socket pushed fully home, thus suspending the drawing horizontally in the body of the unit.

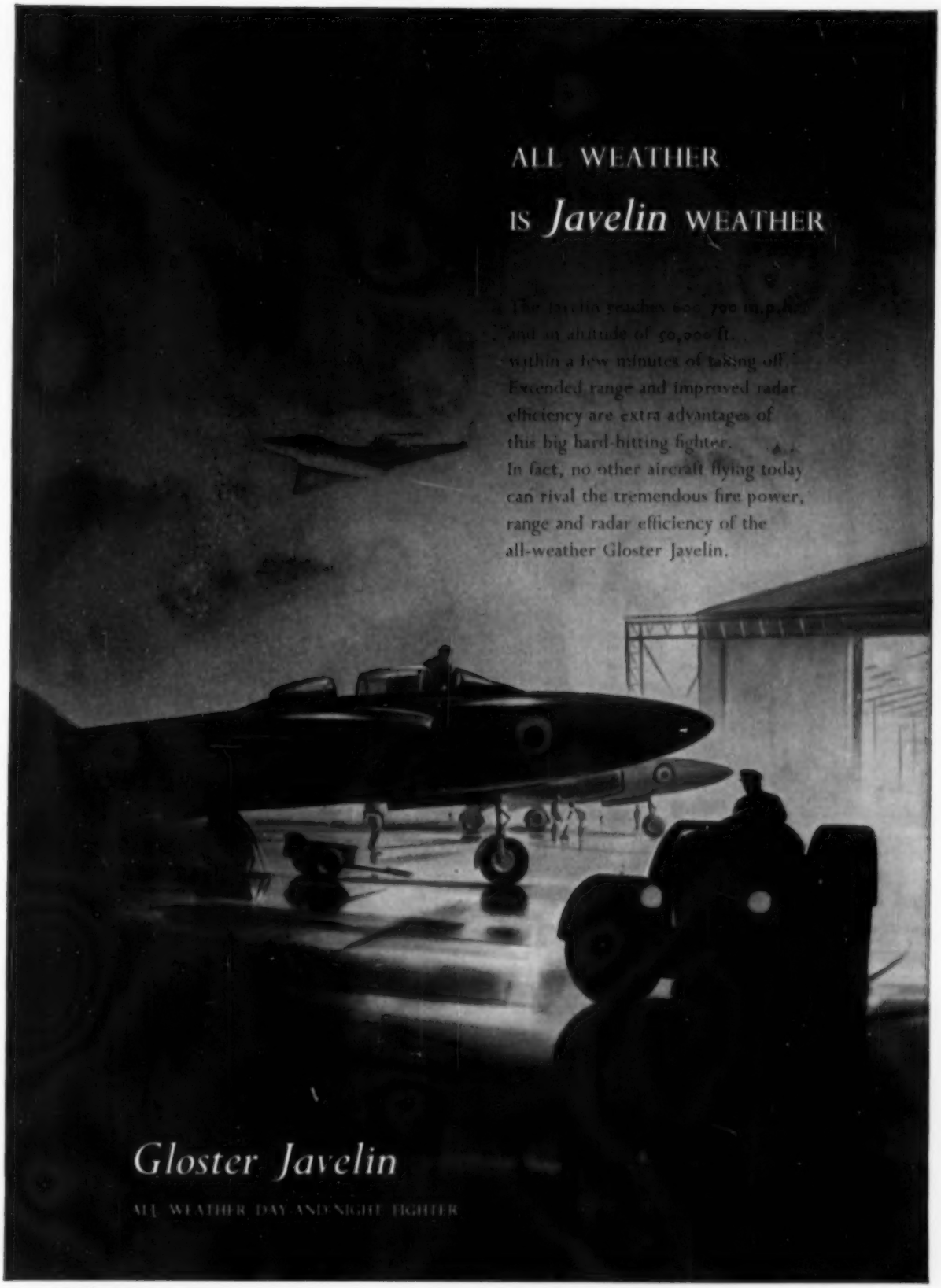
Drawings can be removed and replaced without disturbing others and can be quickly located in the unit by a simple system of reference: when one is removed a "location slip" may be substituted and the socket replaced with its handle in the vertical position, thereby indicating "drawing in use", and the location slip at once identifies the user.

Planstore units are available in three heights, 89in, 46in, and 34in. The unit fronts are divided into approximately 1,200, 600 and 300 compartments. All units are 37in wide but vary in depth according to the size of drawings to be stored.

## INSTRUMENTS ON SHOW

AN exhibition of precision electronic equipment and components made by a number of American and Continental firms was held recently in London. Organized by Rocke International, Ltd., and B. and K. Laboratories, Ltd., the exhibition included equipment for research, production and maintenance. Among the items on view were a sound frequency-analyser and level-recorder made by Bruel e Kjaer of Denmark; various signal generators, oscilloscopes and other test equipment of American design; a temperature-measuring bridge and an audiometer from the Dutch Peekel company; and data recorders from a range suitable for laboratory work on vibration, aerodynamics, gas turbine performance and other aeronautical applications (Ampex Electric Corporation, U.S.A.).

The Rocke company, whose address is 59 Union Street, London, S.E.1, are British representatives for a large number of American and Continental manufacturers of such electrical and electronic instruments, components and equipment.


ALL WEATHER
IS *Javelin* WEATHER
The Javelin reaches 600 m.p.h.
and an altitude of 50,000 ft.
within a few minutes of taking off.
Extended range and improved radar
efficiency are extra advantages of
this big hard-hitting fighter.
In fact, no other aircraft flying today
can rival the tremendous fire power,
range and radar efficiency of the
all-weather Gloster Javelin.
*Gloster Javelin*
ALL WEATHER DAY AND NIGHT FIGHTER

GLOSTER AIRCRAFT CO. LTD., GLOUCESTER. *Member of the Hawker Siddeley Group | Pioneer ... and World Leader in Aviation*

Latest of the long line of famous Fokker aircraft, the F.27 Friendship is fitted with Dowty Liquid Spring main and nose undercarriage for ease of maintenance and sustained efficiency.

# DOWTY
## *Liquid Spring*
## UNDERCARRIAGES

DOWTY EQUIPMENT LIMITED
CHELTENHAM
*Member of the DOWTY Group*

# CIVIL AVIATION

## CYPRUS DEVELOPMENTS

DETAILS of the £500,000 plan for development of Nicosia Airport, Cyprus, during the period 1954-56 are given in the annual report of Mr. D. K. Forsdyke, the colony's civil aviation officer. The plan, most of which has yet to be completed, provides for extension of the main runway from 5,932 to 8,000ft, and of the subsidiary runway from 4,500 to 6,700ft; a new taxi track and hardstanding; improved airfield lighting; and an increase of some 300 per cent in the capacity of the passenger terminal building.

Air traffic to and from Cyprus has increased considerably in recent years (67 per cent of passengers entering or leaving Cyprus do so by air), and this is reflected in statistics for Nicosia Airport. The number of passengers handled there increased from 51,877 in 1952 to 70,602 the following year and to 94,542 in 1954. Civil aircraft movements last year totalled 7,351, scheduled flights increasing by 7½ per cent and non-scheduled by 38 per cent. Military movements exceeded 40,000. Types of civil aircraft most frequently seen at Nicosia included DC-3s (3,495 movements), Yorks (666), Argonauts (486), Viscounts (436), Commandos (371), Hermes (280) and DC-6/6Bs (198).

## WINGS FOR WHEELS

BELIEVED to be the largest long-distance air lift of motor cycles is that recently organized by the Uganda Company in conjunction with the B.S.A. Co., Ltd. The lift—to Entebbe and Salisbury—is the result of lengthy delays in shipping services to East Africa. The airlines concerned are Airwork, Ltd., whose Vikings recently flew three consignments of 25 machines each to Entebbe and Hunting-Clan Air Transport, Ltd., who despatched a Viking-load of 125 c.c. Bantams and 150 c.c. Bantam Majors to Salisbury. Further consignments may exceed the 200 mark. The motor cycles, which were delivered within about 24 hours, were destined for sale to Africans and Indians.

## TEN YEARS OF ACHIEVEMENT

TO mark the tenth anniversary of their respective foundations, I.C.A.O. and I.A.T.A. have jointly published an attractive brochure outlining in popular terms the achievements of post-war civil aviation. The title, *Every Five Seconds . . .*, refers to the world-wide, day-and-night frequency of scheduled air services today.

The brochure observes that the "typical" pre-war airliner had two engines generating 2,400 h.p. and carried 21 passengers over a range of 1,000 miles at 170 m.p.h.; its counterpart of today has four engines generating six times more power, can carry as many as 100 passengers and cruises twice as far at 300 m.p.h. Compared with its pre-war production, civil aviation annually carries "23 times as many passengers, performs 36 times as many passenger-miles, 70 times as much cargo transport and 13 times as much mail carriage."

"The sheer physical accomplishment of the past ten years," is illustrated by the following examples: "324,000,000 passengers in 10 years equals twice the population of the United States; 180,000,000,000 passenger-miles performed represents the amount of transport needed to carry the whole of the populations of the Philippines to New York, or the whole population of Sweden once round the world; 4,240,000,000 ton-miles of cargo transport could transfer all the coffee in Brazil across the South Atlantic, or carry the whole tea crop of Ceylon to Alaska—and back; 1,400,000,000 ton-miles of air mail service would suffice to carry 15,000,000 letters around the world at the equator each week of the ten-year period; 8,500,000,000 aircraft miles flown represents 18,000 round trips to the moon; and to accomplish the 47,000,000 aircraft hours operated in the decade, a single aircraft would have had to start flying 5,365 years ago—in 3410 B.C."

## K.L.M. MODIFY SUPER CONNIES

MODIFICATION of airscrew blades on K.L.M.'s L.1049C Super Constellations is expected to increase the cruising speed of these aircraft by 5 m.p.h., and to improve cooling of the Turbo-Compound engines both on the ground and in the air. The modification, which is being incorporated at K.L.M.'s Schiphol base, has the effect of extending the width of the airscrew blade down to the hub; this is achieved by the addition of a foam-plastic fillet on the trailing edge of each blade. After heating of the blade, the plastic is applied and oven-hardened; protection against atmosphere is provided by a layer of sheet rubber and, finally, a coat of paint.

## ANOTHER BELL FOR ROTORFILMS

ONLY a few weeks after taking delivery of his Agusta-built Bell 47G, Capt. John Crewdson has signed an order for another of these three-seat helicopters. The order is announced by Hordern-Richmond (Sales), Ltd., Bell distributors for Great Britain and Ireland.

A director of Rotorfilms (London), Ltd., Capt. Crewdson is operating his first helicopter on a variety of assignments, ranging from publicity contracts to an airborne trapeze act over the Thames. To publicize the product of a well-known brandy firm, the Bell sometimes carries outsize "hoardings," of appropriate bottle shape. These appendages have remarkably little effect on the performance of the helicopter, and can be detached in 10 minutes; the "bottles" are of light-alloy sheeting, and were fabricated by W. A. Rollason, Ltd., of Croydon Airport.

## NEW SERVICES APPROVED

THE M.T.C.A. announce Ministerial approval, after consideration of the Air Transport Advisory Council's recommendations, of the following scheduled air services:—

**Air Kruise (Kent) Ltd.**—Inclusive tours until October 31st, 1955, between Lydd and Basle; Lydd and Turin *via* technical stop at Nice; Lydd and Venice; Lydd and Salzburg; Manchester and Geneva; Lydd and/or Lympne and Lyons (Bron); and Manchester and Ostend; operation of Dakotas on scheduled services between Lydd and Ostend.

**Airlines (Jersey), Ltd.**—Normal scheduled services between Jersey, Guernsey and/or Alderney and Cherbourg until March 31st, 1963.

**Airwork, Ltd.**—Inclusive tour between London (Blackbushe) and Biarritz until September 17th, 1955.

**B.E.A.**—Normal scheduled services between London and Salzburg *via* an optional stop at Frankfurt (until March 31st, 1962); Manchester (Ringway) and London (optional) and Milan (until May 31st, 1962); and London and Ajaccio and Malta (until September 30th, 1961).

**B.K.S. Air Transport, Ltd.**—Inclusion of a traffic stop at Leeds and a Customs stop at Bournemouth (Hurn) on one return flight per day on their internal service on the route Newcastle and/or West Hartlepool - Guernsey (optional) - Jersey until March 31st, 1957; normal scheduled services from Newcastle to Knocke-le-Zoute and/or Ostend *via* an optional stop at Leeds until April 30th, 1961 (April to October); inclusive tour between Newcastle and/or West Hartlepool and/or Leeds and Lourdes until September 30th, 1956 (April to September); internal services between Leeds and Southend and Leeds and Belfast until April 30th, 1962 (April to October).

**Cambrian Air Services, Ltd.**—The operation of Dakota aircraft on the route Cardiff and/or Bristol - Southampton - Paris; normal scheduled services between Cardiff and/or Bristol and/or Southampton and Nice until March 31st, 1963 (May to September).

**Dragon Airways, Ltd.**—Internal services between Liverpool - Prestwick (optional) - Glasgow until February 28th, 1962.

**Silver City Airways, Ltd.**—Vehicle ferry services between Birmingham and Le Touquet until October 31st, 1961 (May to October).

**Starways, Ltd.**—Internal services between Liverpool and London until October 31st, 1961.

**Transair, Ltd.**—Inclusive tours between Manchester and Ostend (until October 31st, 1955); London (Croydon or Gatwick) and Perpignan, Toulouse, Klagenfurt, Turin and Basle (until September 30th, 1955).

*DC-3s of Starways, Ltd., the Liverpool-based independent operator, now feature an attractive new colour-scheme. This example was photographed recently on the apron at Renfrew.*

*Even the Stratocruiser, giant of the North Atlantic route, is dwarfed by B.O.A.C.'s new Headquarters Building at London Airport. The building is not intended solely for aircraft maintenance; Sir Miles Thomas is moving his office there this month, and by July the H.Q. will house most of B.O.A.C.'s London staff.*

"Flight" photograph

## OUT OF THE LIMELIGHT

RECENT successes of the Viscount sales drive have tended to overshadow the export orders received for smaller types of civil aircraft. Some 65 de Havilland Herons, for example, have now been delivered to 16 countries overseas. Dove sales have passed the 500 mark, and these aircraft are operating in at least 40 parts of the world, the most recent delivery being to Transportes Aéreos de Timor, for internal services.

Hunting-Percival recently announced the first civil order for the survey version of the Pembroke: two of these aircraft have been bought by the Finnish Ministry of Agriculture. Auster Aircraft have delivered ten Autocars to the Argentine for crop spraying, ambulance and passenger work, and 11 more have been ordered. During the past year Austers have also been sold to Australia, Belgium, Norway, Pakistan, Spain, Sweden and West Africa.

## INDEPENDENTS' OSLO MEETING

EUROPE'S major independent operators were represented at the latest meeting of F.I.T.A.P., which was held last month in Oslo. In the chair was Mr. Ludwig Braathen, who will be succeeded as chairman by A. Cdre. Powell at the Federation's next meeting—in Paris on June 15th. Independent airlines from all parts of the world, including American carriers, will be present at this meeting, which will also be attended by observers from interested international organizations and bodies.

At the Oslo meeting, attention was drawn to the issue—then due for consideration by the Norwegian parliament—as to whether certain domestic routes should be operated by S.A.S., the Scandinavian tri-State airline, or by Braathens. The State airline, which is pressing for exclusive rights to operate these services, estimates that they will involve a loss of some £200,000, whereas the independent airline believes that they can be operated at a profit. Difficulties in obtaining scheduled rights have also been experienced by Fred Olsen Air Transport, who recently concluded an agreement whereby their two Viscounts, due for delivery later this year, will be leased to B.E.A.

The meeting also condemned the pressure which is alleged to have been brought to bear on I.A.T.A. agents selling tickets for certain non-I.A.T.A. airline services, though this is permitted under agency agreements. It is believed that the independent carrier concerned is Loftleidir, the Icelandic company which operates transatlantic services at fares 18 per cent below the I.A.T.A. minimum. The meeting also passed a resolution applauding the recent French decision to abolish tax on aviation fuel for domestic services.

# BREVITIES

PAKISTAN INTERNATIONAL AIRLINES announced that they have made the first non-stop commercial flight from Zurich to Karachi. This distinction is claimed for the P.I.A. Super Constellation which on May 23rd covered this 3,970-mile route in 12 hr 50 min at an average speed of 309 m.p.h.

* * *

The Boeing 707 prototype made its 100th test flight on May 19th. The maiden flight was made on July 15th last year in the hands of A.M. "Tex" Johnston, who was also at the controls for the 100th test. Average duration of each flight has been about 1½ hr; the 150 hr mark was, in fact, reached in the 23rd minute of the 100th flight. Production of KC-135s (tanker-transport versions of the 707 for Strategic Air Command) is now under way in Boeing's Renton plant.

* * *

With the restoration of German sovereignty, approval for scheduled or non-scheduled traffic flights into or over West German territory must now be obtained from the Federal Ministry of Transport (Civil Aviation Department), Bonn am Rhein, Lennestrasse 30. The only formality required for non-traffic flights is the submission of a flight plan to the appropriate air traffic control centre.

* * *

A four-engine syncroscope is among the 30 items of Smiths manufacture to be fitted to the Viscounts ordered by Capital Airlines. Others include a special thermocouple harness and engine-speed indicator system for the Dart turboprops, an A.C. direct-mounted oil-pressure measurement system and a range of position indicators and transmitters for control surfaces and other parts of the aircraft.

* * *

Recipients of the 1955-56 fellowships at the Graduate School of Business, Columbia University, awarded by Seaboard and Western Airlines, are R. F. Eggan of Missouri and L. F. G. Jeanjean of Paris. Mr. Eggan, a graduate of the U.S. Merchant Marine Academy, is completing a tour of duty with the Military Sea Transport Service (Atlantic area). Mr. Jeanjean, the first Frenchman to qualify for the award, holds Paris degrees in law and political science. Two such fellowships have been awarded annually by Seaboard and Western Airlines since 1951; their object is to facilitate the study of air freight and to increase public consciousness of the value of air freight.

*A newcomer to the territories served by West African Airways Corporation is the Heron 2. The first of W.A.A.C.'s three Herons is shown with passengers about to leave Lagos for Accra. The occasion was the inauguration of the Heron service, on May 16th, on the Lagos-Accra - Kumasi route.*

Sabena added a tenth city to their helicopter network on May 23rd with the introduction of daily services to Duisburg. Flights operate from Brussels *via* Eindhoven. Other points on the network are Antwerp, Rotterdam, Liége, Maastricht, Cologne, Bonn and Dortmund.

* * *

Trans - Australia Airlines announce that registrations VH-TVH-J inclusive have been allocated to the three Viscount 756s ordered recently for delivery in April/May next year. The airline has also announced the following appointments at its Melbourne office: Capt. R. B. Bailey, acting director of operations; Capt. C. H. Gray, chief pilot; Mr. R. G. "Ben" Cochrane (formerly T.A.A. manager in London), sales manager; and Mr. H. Dentry, publicity manager.

Lufthansa's London office reported "several hundred" bookings within four days of the inauguration of the airline's Convair services to London. British passengers represent two-thirds of the London bookings.

* * *

Passengers' maps covering the Bombay-London section of the Air-India International network have been designed and produced for the company by Francis Chichester. Finely printed in full colour, the maps strike an excellent balance between information and entertainment, providing an accurate reference to the terrain *en route* together with illustrations and marginal notes on places of interest between Bombay and London. Air-India's frequency of service on this route has recently been increased from four to five Super Constellation flights weekly.

# CLUB AND GLIDING NEWS

WILTSHIRE School of Flying, Thruxton, reports that it "never did think much of 'high utilization' of club aircraft —in spite of the fact that it apparently gains air-efficiency awards". Instead of trying to get a lot of flying out of very few aircraft, the club believes in having a large number of machines, in order to cut down members' waiting time. Present fleet strength is four Autocrats, four Proctors and six Tiger Moths, with a further six Tigers and five Proctors in reserve. Another result of possessing a king-size fleet, apparently, is a creditable total of flying hours: for the year 1954-55, club flying amounted to 3,221 hours (compared with 2,700 for the previous year), in addition to 700 hours on Army co-operation work.

Among resident students at Thruxton recently were the school's first two post-war German pilots who, after a refresher course, both obtained British P.P.L.s. The training of A.T.C. cadets continues.

DURING the meeting of the OSTIV Bureau in Zurich in March 1955, a visit was paid by Boris Cijan and Alan Yates to Birrfeld, thirty miles from Zurich, to see the latest Swiss sailplane, Elfe III. They were accompanied by "Pirat" Gehriger, chairman of the F.A.I. gliding commission and secretary of the Swiss Aero Club. Alan Yates reports on the Elfe III:

"The new machine has a span of 16 m and an aspect ratio of 21. The nine-metre centre-section of the wing is placed on the fuselage in one piece; each outer wing and aileron (3.5 m) is added later. The wing has a full-span flap-cum-aileron which has a constant chord of only seven inches. The flaps can be lowered as a whole for slow flying, but they also act as full-span ailerons—the outer part deflecting more than the inner part. The aerofoil was developed by the designer, Pfenninger, and is a laminar-flow section with its greatest thickness as far back as 60 per cent of the chord. The wing is 14 per cent thick at the root and about 12 per cent at the outer wing junction. The whole of the wing, as far back as the tiny flap/aileron, is ply-covered and magnificently free from surface waviness. Dive brakes emerge well back from both surfaces of the wing and are thus unlikely to upset the laminar boundary layer.

"The fuselage is slender and the cockpit very shallow. The owner, Max Schachenman, is small enough to be comfortable but Guido Schaefer, who flew it on the occasion of our visit, is taller and looked cramped. The fuselage is very long but the tail surfaces look very small indeed. The rudder and elevator chords do not exceed 7in. The landing gear consists of a retractable wheel and tail skid; there is no nose skid at all. To prevent nosing over on landing, the wheel is set well forward of the centre of gravity. This results in a considerable weight on the tailskid (a trolley is needed for ground handling) and could lead to difficulties in directional control on landing. The cockpit is comprehensively equipped. The controls include flaps, dive brakes, trimmer, wheel retraction, wheel brake and rudder pedal adjustment. Radio and oxygen are installed.

"Guido Schaefer was aero-towed to 2,500ft on a demonstration flight which he ended with a low pass at 140 m.p.h. The stalling speed is reported to be 45 m.p.h. with flaps down and 55 m.p.h. with flaps neutral. The dive brakes appeared very effective and the landing was straightforward. Each wing tip clears the ground by less than three feet, however, calling for care in both take-off and landing. In flight, the rolling performance looked good, a 45-deg bank reversal taking about three seconds only. Circling in thermals did not appear easy, however; corrections with the rudder and aileron were frequently made, and it seems probable that a greater tail surface area would add usefully to directional and longitudinal stability.

"Over forty flights and thirty hours have so far been flown, and the gliding ratio is said to be better than 35:1."

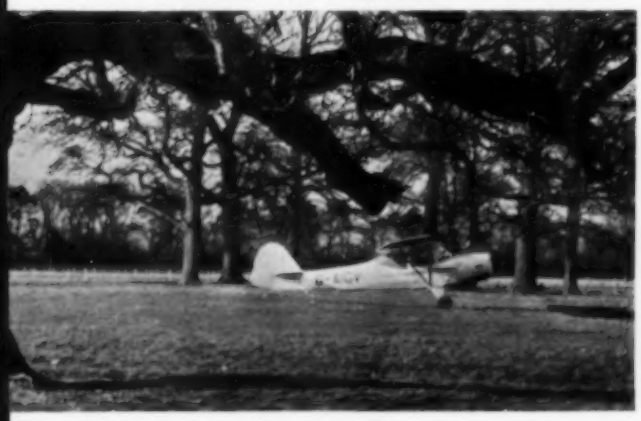
FROM Kuwait, Persian Gulf, S/L. E. Paul Nash, A.F.C. (previously C.F.I. of No. 15 Reserve School, Redhill, and now C.F.I. of the Kuwait Aero Club) has sent the following club news:—

"The Kuwait Aero Club was formed about 18 months ago on the orders of His Excellency Sheikh Abdullah Mubarak as Subah, C.I.E. Two Auster Aiglets and two Autocars were flown out from England in March 1954. The club offers flying training free to selected Kuwaiti students and others, in addition to paid flying at normal U.K. rates.

"Just over 1,800 flying hours were achieved during the first 12 months and eight Kuwaiti students, starting from scratch, obtained their British P.P.L.s. These students have now been sent to the U.K. for further advanced training. Many other members have achieved first solos and are now well on the way to obtaining their licences.

"An impressive ceremony was held to present the first eight Kuwaitis with their licences, and it was when performing this pleasant task that His Excellency announced that he would also present the Club with four more Austers. These have now been delivered, making the club fleet five Aiglets and three Autocars."

***Unusual airfield in this photograph is the privately owned field of Bosworth Hall, Husbands Bosworth, venue of a rally organized recently by Mr. D. C. Maxwell, director of the Ind Coope and Allsopp brewery, and a Gemini-operator. Shown on departure is W/C. Roxburgh's Auster.***



**FORTHCOMING EVENTS**

| | |
|---|---|
| May 30-June 10. | Canadian International Trade Fair and Air Show, Toronto. |
| June 1-10. | Aluminium 1955 Exhibition: Royal Festival Hall, London. |
| June 1-11. | British Plastics Exhibition and Convention: Olympia, London. |
| June 1-18. | Royal Tournament, Earls Court, London. |
| June 3-17. | Aeronautical Union of Jugoslavia: Sixth Federal Gliding Contests, Jugoslavia. |
| June 4-5. | Ninth Rally of the Wines and Chateaux of Anjou, France. |
| June 4-5. | Royal Air Forces Association: Annual Conference. |
| June 7-15. | French Aero Club: F.A.I. 50th Anniversary Rally, Paris. |
| June 10-19. | Paris Aero Show. |
| June 11. | R.Ae.C.: Third National Air Races meeting, Bristol. |
| June 11. | Royal Air Forces Association: Air Display, R.N.A.S. Sydenham, Belfast |
| June 11. | Aircraft Golfing Society: Match v. Racing Club de Paris, La Boulie, Paris. |
| June 17-24. | F.A.I.: General conference. |
| June 18. | R.N.A.S. Eglinton, Northern Ireland: Air Day. |
| June 18. | R.N. Electrical School, H.M.S. "Ariel," Worthy Down, Winchester: Air Day. |
| June 20-July 1. | I.A.S. and R.Ae.S.: Fifth Anglo-American Aeronautical Conference, Los Angeles. |
| June 21-22. | Touring Aircraft Display, Quiberon. |
| June 22. | Women's Engineering Society: Annual general meeting. |
| Sept. 5-11. | S.B.A.C. Show, Farnborough. |

# SERVICE AVIATION

*Royal Air Force and Fleet Air Arm News*

## Malayan Awards

THE Queen has been graciously pleased to approve the following awards to members of the Royal Air Force and British Army in connection with operations in Malaya between June 1st and November 30th, 1954.

**ORDER OF THE BRITISH EMPIRE**

*C.B.E.:* G/C. K. Slater, O.B.E., A.F.C.
*O.B.E.:* W/C. L. Kelly, B.Sc., A.F.R.Ae.S., D.C.Ae.; W/C. W. R. Williams, D.F.C.
*M.B.E.:* Act. S/L. A. F. Derry.

**DISTINGUISHED FLYING CROSS**

S/L. W. H. Mills; F/L. P. J. Langley; F/O. D. Dobie; F/O. F. S. Souness; Capt. C. H. C. Pickthall, R.A.; Capt. D. H. G. Wisdom, R.A.

**DISTINGUISHED FLYING MEDAL**

Sgt. T. Wall; Cpl. A. Abbott, R.A.S.C.

**MENTIONS IN DESPATCHES**

Act. W/C.s F. J. Fenner and A. H. Porter, O.B.E.; S/L.s R. F. Jones and K. R. Manns; Act. S/L.s W. T. Cuthill and G. A. Faux, M.R.C.S., L.R.C.P.; F/L.s J. W. Baxter; W. D. Bailes; W. S. Brown; E. H. Pollard; G. F. Rideout; F. J. Roberts; D. H. Tew; R. Tuffin; N. Walling and L. T. Walton, D.F.C.; F/O.s J. E. Bore; C. T. Lake and E. A. Taylor, B.A.; W/O. L. S. Wallis.

F/S.s W. T. Ball; R. J. W. T. Barton; A. R. Clisby; R. D. Edwards and W. N. F. Wollan; Sgts. F. A. Bass, W.R.A.F.; J. H. Douglas; A. C. Johnstone and F. W. Winter; Act. Sgt. D. F. Stent; Cpl. F. King; Cpl. Tech. A. R. Perry; Jun. Tech. S. Walker; Sen. A/C. P. W. Bedwell and P. W. Rose.

**BRITISH EMPIRE MEDAL**

Sen. Tech. D. M. Harper; Cpls. P. J. Barker; C. Johnson and H. F. Jury.

## No. 601 Adoption and Affiliation

ON May 24th, the London County Council in session unanimously agreed that it should adopt No. 601 (County of London) Squadron, R.Aux.A.F., "in recognition of the historic part played by the squadron in the defence of London, its outstanding contribution to victory in the second world war, and its close association with the County of London." The motion was moved by Mr. I. J. Hayward, and seconded by the leader of the Opposition, Sir Norris Kenyon.

A copy of the resolution is being sent to the Duke of Edinburgh, who is the Honorary Air Commodore. He will attend a ceremony at County Hall on June 8th at which the adoption will be formally recognized.

On May 24th, also, the Air Ministry announced the affiliation of No. 601 to No. 24 (City of Adelaide) Squadron, Royal Australian Citizen Air Force. The purpose of this affiliation is to foster a close relationship between the squadrons by a regular exchange of information about training and social activities and by the extension of hospitality to members visiting one another's countries.

No. 24 Squadron, now commanded by S/L. V. B. Cannon, D.F.C., was formed in 1940, originally for general-purpose duties, and served in the South and South-West Pacific areas during the war. In 1943 and 1944, it operated in New Guinea as a dive-bomber squadron armed with Vengeance aircraft. Later in 1944, it was re-equipped with Liberators for the heavy-bomber rôle. The squadron was disbanded in 1946 and re-formed as a fighter squadron of the Royal Australian Citizen Air Force on April 30th, 1951.

The Honorary Air Commodore of No. 24 (City of Adelaide) Squadron is A.V-M. Sir Robert George, K.B.E., C.B., M.C., the Governor of South Australia.

No. 601 Squadron was formed in 1925 and embodied for active service when war began in 1939. The squadron served in the United Kingdom, where, armed with Hurricanes, it took part in the Battle of Britain, in Middle East theatres and in Italy, mainly in the fighter and fighter-bomber rôles, until 1945. It was re-constituted on a peace-time basis in 1946. It is commanded by S/L. C. C. McCarthy-Jones, A.F.C.

*Avon-Sabres of the Sabre Trials Flight at the Royal Australian Air Force base at Williamtown, New South Wales. These aircraft are built by the Commonwealth Aircraft Corporation at Fisherman's Bend.*

*Units of Church Fenton, commanded by G/C. C. F. Gray, D.S.O., D.F.C., have won both the Dacre and Esher Trophies. Left to right: S/L. B. Beard, A.F.C., No. 19 Sqn., with the Dacre Trophy; W/C. R. W. Oxspring, D.F.C., A.F.C. (Wing Commander Flying) and S/L. E. Evans, No. 609 (West Riding) Sqn., R.Aux.A.F., with the Esher Trophy.*

## Sir Francis Mellersh

WITH great regret we record the death of A.V-M. Sir Francis Mellersh and Lt-Cdr. M. Baring as the result of an accident to a Naval helicopter near Chichester.

According to reports, the helicopter, a Dragonfly, had flown Lt-Cdr. Baring to the Itchenor Sailing Club and had hovered while he stepped off to meet Sir Francis. As it turned to head out to sea again its tail rotor struck the mast of a dinghy and the aircraft went out of control. Both men were struck by the rotor blades.

Sir Francis Mellersh, who retired from the Service last year, joined the R.N.A.S. in 1916 and transferred to the R.A.F. in 1918. As a senior officer he spent much of his service in the Far East. He was Air Commander, Strategic Air Force South-East Asia, from 1944 to 1945 and A.O.C. Malaya from 1949 to 1951. Before retirement his last appointment was Commandant-General of the R.A.F. Regiment.

## Flying Risk Insurance Concessions

THE Air Ministry announces that, as from April 1st, R.A.F. officers and airmen of the flying categories who pay extra premiums on life insurance policies to cover flying risks can have 75 per cent of this additional expense refunded, up to a maximum assured sum of £2,000. With income-tax relief, this new concession will mean that in the great majority of cases men who cover themselves against flying risks in this way will be able to do so at little or no cost to themselves. The concession is additional to the flying pay and other benefits already enjoyed by members of the flying categories.

A similar concession will also apply to personnel who do not ordinarily fly, and the Royal Navy and the Army are making comparable arrangements.

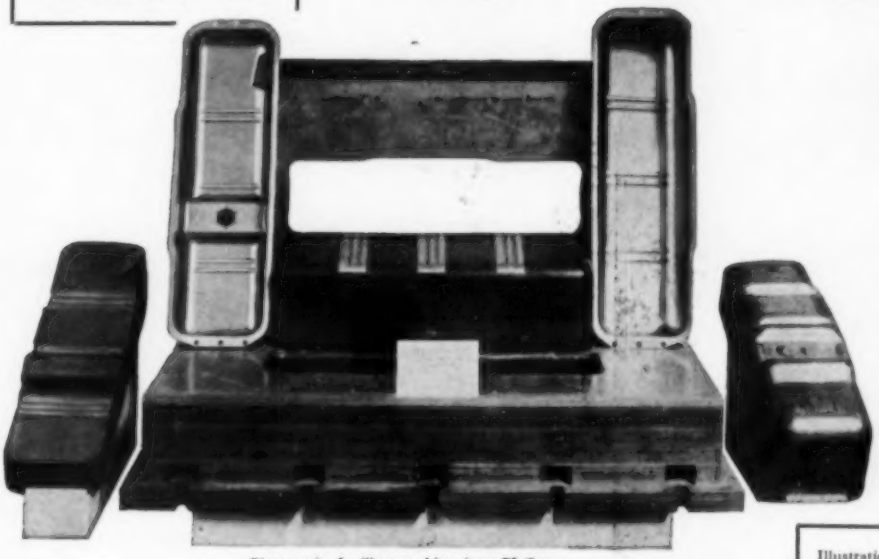
## No. 151 (F) Squadron History

A SHORT history of No. 151 Squadron has recently been published in booklet form. A limited number of copies are available free of charge to ex-members of the Squadron, who are invited to apply to the Commanding Officer, 151 Squadron, Royal Air Force, Leuchars, Fife.

KNOWN THROUGHOUT THE AIRCRAFT INDUSTRIES OF THE WORLD

# "Hy-du-lignum"

laminated compressed wood



# PROVEN

## FOR MECHANICAL PRESS TOOLS

- One-fifth the weight of steel.
- Low cost

Supplied as finished tools or in board form.

Please write for illustrated brochure SL/8 to

## HORDERN-RICHMOND (SALES) LTD.

HEAD OFFICE: HY-DU-LIGNUM WORKS, HADDENHAM, BUCKS, ENGLAND.
NORTHERN OFFICE: BARTON ARCADE, DEANSGATE, MANCHESTER.
Telephone: AYLESBURY 1100-1102. Telegrams: WINSTIX, AYLESBURY.

Illustration shows "Hy-du-lignum" Press Tool, used on DH 600 Clearing, Treble Action Press for 20 gauge mild steel Petrol Tank Body Pressings. Interchangeable Punches and Ejectors with common die and pressure plates to produce top and bottom body halves, 3 ft. long × 10 in. wide × 8 in. deep. Photograph by courtesy of Morris Motors (Radiators) Limited.

# MARICON FLEXIBLE HOSE

## A BETTER HOSE OF LIGHTER WEIGHT M.O.S. APPROVED FOR LOW PRESSURE FUELLING SYSTEMS

Maricon Hose is fully approved under M.O.S. Specification D.T.D. (R.D.I.) 3951 and is included in S.D.M. No. 101 (Issue 4) and S.D.M. 183 (Issue 3). Both types A (Non Fire Resistant) and B (Fire Resistant) offer remarkable weight saving advantages as compared with similar hoses and can be supplied in long lengths, or assemblies. Type B has been proved by exhaustive tests to have exceptional fire-resisting qualities. We shall be pleased to supply specification, drawings, and full details on request.

*"MARICON" HOSES INCORPORATE "HALLPRENE" SYNTHETIC RUBBERS*

MARICON LIMITED, OLDFIELD ROAD, HAMPTON, MIDDLESEX
(MOLESEY 2180)

CHECKING
INSPECTION
OVERHAUL
IN AVIATION NEED THE CONSTANT VIGILANCE AND TECHNICAL KNOWLEDGE OF HIGHLY SKILLED PERSONNEL
AT SABENA
3 PERSONS OUT OF 5 UNDERTAKE THIS DIFFICULT TASK DAY AND NIGHT
THEY COMPLETE IT WITH AN EFFICIENCY THAT HAS EARNED A HIGH REPUTATION FOR THE BELGIAN AIRLINE THROUGHOUT THE WORLD
GIVE THEM YOUR CONFIDENCE
WITH SABENA YOU ARE IN GOOD HANDS
SABENA

Expert analysis of famous British motor cycle engines

SECOND SERIES—NOW READY

**Models Described:**

*A.J.S. 7R*
*A.J.S. & Matchless 347*
*A.J.S. and Matchless Parallel Twins*
*Ariel Red Hunter*
*Ariel Twin*
*B.S.A. Golden Flash*
*British Anzani*
*Douglas Dragonfly*
*Norton Manx 499 c.c. and 348 c.c.*
*Panther 100*
*Royal Enfield Bullet*
*Triumph Terrier*
*Triumph Thunderbird*
*Velocette M.A.C.*
*Velocette MSS*
*Vincent Rapide*

**3/6 net.** By post 3/9

# Motor Cycle Engines

Famous British power units analysed by the staff of "The Motor Cycle" in words and drawings. Special sectioned perspective drawings show every detail of each engine and the designers, in discussions with experts of "The Motor Cycle", reveal the reasons for various features of design materials, etc.

Get your copy from your bookseller TO-DAY

or direct from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1

**WE ARE A.I.D. AND A.R.B.**
**APPROVED STOCKISTS**

*W. Wilson & Sons* (LONDON) *Ltd.*
*Registered Office: 3, Chalfont Road, N.7*
*Works: 6, Sheringham Road, N.7*
*Telephone Nos. North 4476/7/8 & 2546*

**THIS WAY**

**for the best advance picture of Britain's Plastics Industry, 1955**

Published by the organizers of the exhibition, the June issue of BRITISH PLASTICS gives the first news of what the plastics industry has achieved. It contains floor plans of the exhibition, descriptions of exhibits and quick-reference charts to material manufacturers, moulders, fabricators, plant and equipment. It serves not only as a daily Show Guide, but is a permanent buyers' reference for everyone engaged in the industry.

**A PERMANENT**
Buyers' Guide to the Plastics Industry

**A GUIDE**
to the Exhibition and Convention

BRITISH PLASTICS
Show Guide
**Now on sale**
**FROM YOUR NEWSAGENT - 2s. 6d.**

FLIGHT and AIRCRAFT ENGINEER

PRESS DAY — *Classified advertisement "copy" should reach Head Office by* FIRST POST THURSDAY *for publication in the following week's issue subject to space being available.*

# CLASSIFIED ADVERTISEMENTS

**Advertisement Rates.** 4/- per line, minimum 8/-, average line contains 6-7 words. Special rates for Auctions-Contracts, Patents, Legal and Official Notices, Public Announcements, Public Appointments, Tenders 5/- per line, minimum 10/-. Each paragraph is charged separately, name and address must be counted. All advertisements must be strictly prepaid and should be addressed to FLIGHT Classified Advertisement Dept., Dorset House, Stamford Street, London, S.E.1.

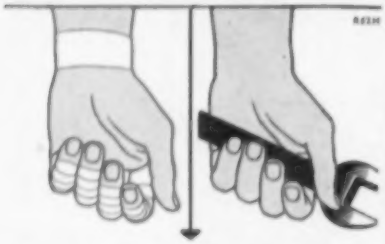
**Postal Orders** and cheques sent in payment for advertisements should be made payable to Iliffe & Sons, Ltd., and crossed & Co.

**Trade Advertisers** who use these columns regularly are allowed a discount of 5% for 13, 10% for 26 and 15% for 52 consecutive insertion orders. Full particulars will be sent on application.

**Box Numbers.** For the convenience of private advertisers, Box Number facilities are available at an additional charge for 2 words plus 1/- extra to defray the cost of registration and postage, which must be added to the advertisement charge. Replies should be addressed to "Box 0000, c/o Flight," Dorset House, Stamford Street, London, S.E.1.

**The Publishers** retain the right to refuse or withdraw advertisements at their discretion and do not accept liability for delay in publication or for clerical or printer's errors although every care is taken to avoid mistakes.

**Situations Vacant.** The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

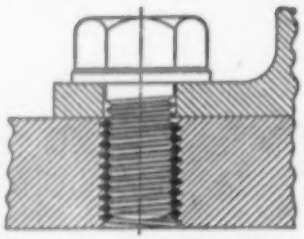



**WHY RISK DERMATITIS?**

Lost hands or full production? Dermatitis—the cause of more lost man-hours than any other industrial disease—can be avoided simply by using Rozalex. For over 25 years Rozalex have specialised in barrier creams for industry. They have found the answer to most industrial skin irritants. The full technical resources and experience of Rozalex are at *your* disposal on request to Rozalex Ltd., 10 Norfolk Street, Manchester 2.

**ROZALEX**
**BARRIER CREAMS**

WIRE
**THREAD INSERTS**



FOR NEW DESIGNS AND SALVAGE
**CROSS MFG. CO. (1938) LTD.**
**COMBE DOWN, BATH**
Tel. COMBE DOWN 2355/6


## AIRCRAFT FOR SALE

### CARTWRIGHT HAMILTON AVIATION

OFFER the following selection from the many aircraft available:

**£14,750** D.H. Dove, low engine and airframe hours, executive interior, fully comprehensible, radio equipment.

**£17,500** Lockheed 12A, luxurious long range 6-seater, suitable for executive use.

**£3200** Percival Q6, 12 months C. of A., 11-channel V.H.F., in excellent condition.

**£1625** Miles Gemini 1A, V.H.F., 12 months C. of A.

**£495** Percival Proctor Mk. IV, 4-channel V.H.F., 12 months C. of A.

**£525** Percival Proctor Mk. IV, 4-channel V.H.F., dual control, 12 months C. of A.

**£425** Taylorcraft "Plus D," low engine hours, dual control, 12 months C. of A.

**£225** D.H. Tiger Moths, 12 months C. of A.

ALSO available Dakotas, Yorks, Bristol Freighters, Rapides, Ansons, Consuls and several amphibians and a large number of light aircraft for private owners.

PART exchange and financial facilities arranged.

PLEASE contact Cartwright Hamilton Aviation, Ltd., 282 Kensington High Street, W.14, Western 0207 and at Croydon Airport. Telegrams Autavia. [0751

### W. S. SHACKLETON, LIMITED

EUROPE'S LARGEST AEROPLANE BROKERS
23 years at 175 Piccadilly
132 different types of aircraft sold
offer for immediate delivery:

SUPER AUTOCARS J/5G.
D.H. DOVES.
BRISTOL WAYFARERS 31E.
HANDLEY PAGE MARATHONS.
MILES MESSENGERS.
PERCIVAL PROCTORS.
MILES GEMINIS.
TIGER MOTHS.
AUTOCRATS.
AUSTER V.
AUSTER J.4.
AIGLET TRAINER.
MILES FALCON VI.
MILES MAGISTER.
AIRSPEED CONSULS.

W. S. SHACKLETON, LIMITED, 175, Piccadilly, London, W.1. Cables: "Shackhud, London." Telephone: HYDe Park 2448/9. [0070

### R. K. DUNDAS, LIMITED

SPRING into the air this summer on a magic carpet by Auster, Percival, Miles or De Havilland. Have you noticed how ridiculously cheap aeroplanes are these days—and cheaper to run since the Royal Aero Club 5-year maintenance scheme.

WE pack and ship them abroad, too—by the dozen!

R. K. DUNDAS, LTD., 29 Bury Street, London, S.W.1. Tel.: WHI. 2848. Cables: "Dundassaero, Piccy, London." [0559

TIGER MOTH, perfect, £225, 12 months C. of A. —Airviews, Ltd., Manchester Airport. [0945

VENDAIR of Croydon Airport can supply most types of British aircraft. Full details from Vendair, Croydon Airport. Croydon 5777. [0603

CHIPMUNK. New C. of A. Nil Engine hours. £2,250. TIGER MOTH. New C. of A. Part exchange or H.P. facilities.
LONDON AERO CLUB, LTD., Panshanger Aerodrome, Herts. Essendon 301. [0280

PROCTOR IV four-seater. Airframe hours 400. Engine hours 200. Full twelve months C. of A. £425. Immediate Delivery. Wescol, Queensbury, Bradford. Tel. Queensbury 2381. [3780

TIGER MOTH, 1,400 engine hours to run, 3 yrs. C. of A. expires Jan., 1958. Blind flying hood. £325 o.n.o. Seen London area. Battersea 3751 after 7 p.m. SHE. 4294. [3792


***Machinists of plastics for the Aircraft Industry***
A.I.D. & A.R.B. APPROVED
Fairleads, Cleats, Panels, Knobs, etc.
**E. S. ASTON & CO. LTD.**
4 SEBASTIAN STREET
CLERKENWELL, LONDON, E.C.1
*Telephone:* CLERKENWELL 2179

**GROUND EQUIPMENT**
Large Range
**EX STOCK**
**Aero Maintenance Equipment Limited**
**100a Clapham Park Road, London S.W.4**
Tel. MACaulay 2477/8

*The . . .*
**British Air Line Pilots' Association**
95 MOUNT STREET, W.1
*Tel.: GROsvenor 6261*
Membership open to all Commercial and Service pilots. For full details as to the objects and particulars of Membership please write to Secretary.

**INVERTERS & SPARE PARTS**
**CLARENCE CARRUTHERS, INC.**
***79 Wall Street, New York, N.Y.***
Exporters-Manufacturers and Dealers
Cable Address: CLARCARRU, N.Y.

**AIRCRAFT and ENGINE PARTS**
DOUGLAS — LOCKHEED — BEECHCRAFT
P & W—WRIGHT—LYCOMING—US RUBBER
GOODYEAR—ELECTRONIC PARTS
*Immediate attention and prompt shipment*
Assure complete satisfaction
**ATLANTIC AVIATION**
TETERBORO, N.J., U.S.A. Cables: Atlantic Teterboro

**COTTON BAGS**
FOR SPARE PARTS, ETC.
**WALTER H. FELTHAM & SON, LTD.**
**Imperial Works, Tower Bridge Road,**
*Telephone: HOP 1784* **LONDON, S.E.1**

**AEROSERVICES**
LIMITED
AIRCRAFT—Several types of both light and medium/heavy aircraft available.
SPARES—Large stock of both Airframe and Engine Spares, particularly for the Dakota Aircraft, Pratt and Whitney Series R.1830 Engines and Lycoming Series O-290-3 Engines. *Send for Details.*
**CROYDON AIRPORT, ENGLAND**
*Tele:* CROydon 9373 *Cables:* Aeroserv, Croydon

Terms to Flying clubs

★

**18/6**

All Post Orders Free

**RACING and TOURING GLOVES No. 807**

String backs, leather palms. Cool in wear. Excellent Motoring or Flying Gloves.

★

Latest Pattern **R.A.F. ANTI-GLARE SUN SPECTACLES** Complete with strong case.

**22/6**

*Send 3d. for illustrated catalogue*

**Lewis LIMITED**

(Dept. F) 124 Gt. Portland Street, London, W.1.

*Tel: Museum 4314. Grams: Aviakit, Wesdo, London*

**LIEBERMAN and GORTZ 21X47 Sent for 17/6**

**WONDERFUL 21 MAGNIFICATION!**

Brighter, more powerful, and wider angle than any other Continental Prismatic Binoculars. Fantastic, and a revelation. ONLY our 21 x 47 (O.G. internal diameter) lenses give such 3-D viewing. Day and night BLOOMED LENSES. 9½in. x 6½in. 28 oz. With case, etc., 17/6 dep., balance payable over 8 months. Cash price 19 gns. Worth much more.

OTHER MODELS

| | | | |
|---|---|---|---|
| 8 x 25—£10 17 6 | | 8 x 30—£11 17 6 | |
| 8 x 32—£13 19 6 | | 8 x 40—£15 19 6 | |
| 10 x 40—£17 19 6 | | 12 x 40—£18 19 6 | |
| 15 x 40—£19 19 0 | | 20 x 40—£19 19 0 | |
| 16 x 50—£48 0 0 | | *Or all on Terms.* | |

*Lists Binoculars, Watches, Tents, etc. Terms.*

**HEADQUARTER & GENERAL SUPPLIES, LTD.**

**(FL/63) 196/200 Goldharbour Lane, Loughboro Junc., London, S.E.5.** Open all Sat. 1 p.m. Wed.

INDUSTRIAL **JRS** DESIGNERS

**J. R. STAINES & PARTNERS LTD**

BATH AND SALISBURY

AIRCRAFT DESIGN
JIG & TOOL DESIGN

SPECIAL PURPOSE MACHINES
STRUCTURAL ENGINEERING

*EXPERIENCED TECHNICAL STAFF*

LONDON OFFICE
115 ST. STEPHEN'S HOUSE
WESTMINSTER, S.W.1
TRA 4954-5


## AIRCRAFT WANTED

AUSTER Mk. IV and V. Any condition with or without engines. Also spares. Fullest details to Box 2875. [3517

## AIRCRAFT FOR HIRE

AUSTERS for hire; anywhere in the U.K. or Continent. Ideal for touring; hours for commercial; aerial holidays, etc. Large fleet available. Daily or weekly rates.—Portsmouth Aero Club, Airport, Portsmouth. Tel.: 717641. [3699

## AIRCRAFT ACCESSORIES AND ENGINES

A. J. WALTER, A.J.W. (Instruments), Ltd.

AIRCRAFT spares.

ENGINE spares.

ACCESSORIES.

INSTRUMENTS.

WRITE, call, cable or telephone.

A. J. WALTER, Gatwick Airport, Horley, Surrey. Horley 1420 and 1510 (Ext. 105/6). Cables Cubeng, London. [0268

MILITARY and civil aircraft and engine spares.—Morris and Horwood, Ltd., 9 Cavendish Square, W.1. Tel.: Langham 6467. [0013

AEROCONTACTS, LTD., Gatwick Airport, Horley, Surrey. Suppliers of: radio, electrical, ground equipment, raw materials, A.G.S. Tel.: Horley 1510. Cables: "Aerocon," Horley. [0972

## AIRCRAFT ACCESSORIES AND ENGINES WANTED

LYNX 4c aero engine for installation into Avro 621 Tutor, or engine spares wanted.—Particulars Derby Aviation, Ltd., Derby Airport. [3797

## AIRCRAFT PROCUREMENT

GP. CAPT. EDWARD MOLE, B.Sc., A.F.R.Ae.S., 31 Dover Street, London, W.1. Tel.: Grosvenor 5902.

SPECIALIST in the procurement of aircraft and aviation equipment on behalf of clients at home and overseas. Representation and agencies invited. [0401

## AIRCRAFT SERVICING

REPAIRS and C. of A. overhaul for all types of aircraft.—Brooklands Aviation, Ltd., Civil Repair Services, Sywell Aerodrome, Northampton. Tel.: Moulton 3218. [0307

## CAPACITY AVAILABLE

CAPACITY available for all classes civil aircraft overhaul, repair and modification.

WE specialize in conversions and radio installation to customer's requirements.—Apply, Helliwells, Ltd., Birmingham Airport, Elmdon, Birmingham, 26. [3764


**AIRCRAFT SPRING WASHERS**

TO B.S. SPECIFICATION S.P.47

**CROSS MFG. CO. (1938) LTD., COMBE DOWN, BATH**

**R.A.F. OFFICERS UNIFORMS**

LARGE SELECTION IN STOCK
*NEW AND RECONDITIONED*
**FISHERS,** 86/88 WELLINGTON ST. WOOLWICH, S.E.18 'PHONE 1055

**FIELD'S**

*A Hunting Clan Company*

*Offer*

**TWO HILLER 360 HELICOPTERS**

**FOR IMMEDIATE DELIVERY**

★

**EXCELLENT CONDITION**

★

**FULLY OVERHAULED**

★

**CONVERTED AND MODIFIED TO HILLER MODEL 12B STANDARD**

**FITTED WITH NEW 200 H.P. ENGINES**

*Full details from:*

**FIELD AIRCRAFT SERVICES LIMITED**

CROYDON AIRPORT
CROYDON, SURREY

Phone: CROydon 7777
Cables: FIELDAIR, Croydon

*A.P. 129-208*

## WIND TUNNEL ENGINEERS FLIGHT TEST OBSERVERS AND DRAUGHTSMEN

The Bristol Aeroplane Company, at Filton, urgently require the following staff to carry out an extensive programme of research and development:

**INTERMEDIATE and SENIOR WIND TUNNEL ENGINEERS**

to staff the new sub-sonic and super-sonic wind tunnels. Applicants should possess either a degree or Higher National Certificate in aeronautical or mechanical engineering. Experience of wind tunnel work is essential for the senior positions.

**INTERMEDIATE and SENIOR FLIGHT TEST OBSERVERS**

to staff the Fixed Wing and Rotating Wing Sections of the Flight Research and Development Department.

Applicants should possess either a degree or Higher National Certificate in aeronautical or mechanical engineering, or a degree in physics or mathematics, and they should be interested in extensive flying during flight trials, and flight trial analysis.

**INTERMEDIATE and SENIOR DRAUGHTSMEN**

are required in both the Wind Tunnel Department and the Flight Research and Development Departments to undertake the interesting and varied model drawing instrumentation and structural work.

Good salaries are offered with prospects under excellent working conditions with extensive pension and welfare schemes.

Applications, giving details of experience qualifications and salary required, quoting **D.O.37**, should be addressed to the **Personnel Manager, The Bristol Aeroplane Company Limited, Aircraft Division, Filton House, Bristol.**



## SHORT BROTHERS AND HARLAND LIMITED

have vacancies in their

## GUIDED WEAPONS DEPARTMENT

1. **CHIEF STRESSMAN**—a qualified stressman initially as a Group Leader but with an early prospect of becoming CHIEF STRESSMAN. The Appointment requires some experience in this field and is an excellent opening for the right young man.

2. **STRESSMEN** — for work on GUIDED WEAPONS and on SPECIAL PRODUCTS. These Departments are expanding and so present good prospects. They are housed in a completely new and modern factory.

3. **AERODYNAMICISTS**—for control and stability problems.

4. **QUALIFICATIONS:** Degree in Engineering with aeronautical subjects or H.N.C. with relevant subjects and some experience in this field.

The amenities expected from a large and progressive Company are available.

Assistance with housing and removal expenses.

Applications, which will be treated in the strictest confidence, should be made to the

**Staff Appointments Officer, P.O. Box 241, Belfast, quoting S.A.64.**


### CLOTHING


R.A.F. and R.N. officers' uniforms purchased; large selections of R.A.F. officers' kits for sale, new and reconditioned.—Fishers, Service Outfitters, 86-88, Wellington Street, Woolwich. Tel.: Woolwich 1055. [0567


### CLUBS


SURREY FLYING CLUB, Croydon Airport, M.C.A. approval for private pilot's licences. Open seven days a week. Croydon 7744. [0292

LONDONERS! Your most accessible and reasonable club. M.C.A. approved courses. Austers 45/- hour, trial lesson 17/6. Penguin Flying Centre. VIC. 1300. [0285

HERTS AND ESSEX AERO CLUB, Stapleford Tawney Aerodrome. M.C.A. approved private pilot's licence course. Auster, Gemini, Tiger, Hornet, Messengers and Proctor aircraft. Trial lesson 35/-, 15 miles centre of London. Central Line Underground to Theydon Bois, bus 250 to club. Open every day.—Tel.: Stapleford 210. [0230


### CONTACT LENSES


MODERN CONTACT LENS CENTRE, 7 (DI) Endsleigh Court, W.C.1. Deferred terms. Booklet sent. [0342


### CONSULTANTS


R. W. SUTTON (CONSULTANTS), LTD., 7 Lansdowne Place, Cheltenham. Tel.: 5811. [0291

WING COMMANDER R. H. STOCKEN, F.R.Ae.S., Eagle House, 109 Jermyn Street, London, S.W.1. Tel.: Whitehall 8863. [0419

R. K. DUNDAS, LTD., have been giving the correct answer to aviation problems for twenty years. Technical. Purchasing. Operations. Marketing.—29 Bury Street, London, S.W.1. WHI. 2848. [0560


### PHOTOGRAPHY


AIRCRAFT cameras K20, K24, F24, F52, etc. We have large stocks equipment, including controls, mounts lenses and processing tanks, film.

HARRINGAY PHOTO SUPPLIES (FM), 423 Green Lane, N.4. MOU. 2054. [0233


### PUBLIC ANNOUNCEMENTS

#### AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:

APPLICATION No. 480. From Airwork, Ltd., of 15, Chesterfield Street, London, W.1, for an All Freight Service with York, Viking, Bristol 170, Dakota, D.C.4 and D.C.6A aircraft for the carriage of Freight only on the route London Airport—Dusseldorf—Frankfurt—Stuttgart—London Airport at a frequency of 200 return flights per year increasing further in accordance with traffic demand for a period of 10 years, commencing two weeks after date of approval. The Company also ask for permission to integrate this service at their discretion with their other All Freight Services already approved for operation to European destinations.

APPLICATION No. 60/1. From Manx Airlines, Ltd., of Ronaldsway Airport, Isle of Man, for continued approval of their Seasonal U.K. Internal Service with D.H.89 and Dakota aircraft for the carriage of passengers, supplementary freight and mail between Isle of Man (Ronaldsway) and Carlisle (Kingstown) at a frequency of up to ten services daily during the season from May to Septembr inclusive each year, for a period of 10 years, commencing 31st May, 1956.

APPLICATION No. 460/1. From British Overseas Airways Corporation of Airways House, Great West Road, Brentford, Middlesex, for permission to include optional traffic stops at Dacca and Rangoon on the All Freight Service which they operate between London and Singapore (and Sydney should Application No. 460 be approved) on the route set out as Route 1 in Schedule "B", Part I, of the Terms of Reference issued to the Air Transport Advisory Council by the Minister of Civil Aviation on 30th July, 1952.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [3798


THERE IS

## SPACE

AT THE

## TOP

for **STRESSMEN** of experience and ability as **STRUCTURAL ENGINEERS** in a well-known firm in the **THAMES VALLEY** area. Houses to rent are available for those appointed to these positions.

WE ALSO WANT SENIOR:

**AERODYNAMICISTS**
**WEIGHT CONTROL ENGINEERS**
**TEST ENGINEERS**
**DESIGN DRAUGHTSMEN**
**JIG AND TOOL DRAUGHTSMEN**

We can offer excellent salaries with a good contributory pension and life assurance scheme, also excellent sports facilities. The factory is a growing concern in a pleasant district

Please send full particulars of experience to **Box No. AC 06682, Samson Clark & Co., Ltd., 57/61 Mortimer St., London, W.1.**



## GUIDED WEAPONS

The Bristol Aeroplane Company Limited at Filton offers the following appointments in the Guided Weapons Department:

(a) **FLIGHT DEVELOPMENT GROUP** Two Technical Engineers for planning a development programme. Both should have an Honours Degree in Engineering or equivalent professional qualifications. One should have experience of Automatic Control Systems and the other should have experience of Flight Development. In the latter case, specialized experience of structures and/or aerodynamics would be an asset.

(b) **A Project Planning Engineer** with sound general and mechanical engineering training and experience. An engineering degree or equivalent professional qualification would be desirable.

(c) **A Ground Equipment Engineer** with general engineering experience and qualifications together with some electronic engineering experience.

Applications, giving details of experience, qualifications and age, quoting D.O.39, should be addressed to the

**Personnel Manager, The Bristol Aeroplane Company Limited, Aircraft Division, Filton House, Bristol.**

## GUIDED WEAPONS
### PROJECT DESIGN

The Guided Weapons Department of The Bristol Aeroplane Company Limited at Filton invites applications from qualified Engineering Designers for appointment to the following posts:—

**(a) DEPUTY PROJECT DESIGNER (AIRFRAMES)**

Applicants should possess high academic or professional qualifications in aeronautical engineering and should have had considerable experience of the design of airframe structures, including recent experience of high speed aircraft or missiles.

**(b) DEPUTY PROJECT DESIGNER (GROUND EQUIPMENT)**

Applicants should possess good academic or professional qualifications in mechanical engineering, and should have had a great deal of design experience of fabricated structures and mechanisms, such as medium ordnance equipment, road transport vehicles, or large-scale agricultural equipment.

Both appointments are of monthly staff status and carry a good starting salary, according to qualifications and experience.

They offer every prospect for advancement in a new and rapidly expanding field of engineering, and the guarantee of a permanent and pensionable employment, which only a large and well-established organization can give.

Applications, giving details of experience, qualifications, and age, quoting **D.O.40,** should be addressed to the **Personnel Manager, The Bristol Aeroplane Company Limited, Aircraft Division, Filton House, Bristol.**

## DEVELOPMENT AND PRODUCTION

Manufacturers of materials handling equipment have vacancies for the following senior appointments:—

**CHIEF INSPECTOR**
(Also responsible for test)

**DESIGN ENGINEER (Electrical)**

**DESIGN ENGINEER (Mechanical)**

**DEVELOPMENT ENGINEER (Electrical)**

**JIG and TOOL DRAUGHTSMAN**

**PLANNING ENGINEER (Electrical)**

**PRODUCTION FOREMAN (Electrical)**

HOUSING ASSISTANCE if required. Factory and offices situated in pleasant country surroundings, one hour's journey from London. Please write giving details of age, past experience, qualifications, married/single, present salary to the

**Personnel Dept.,**
**LANSING BAGNALL LTD.,**
**Kingsclere Road, Basingstoke, Hampshire**

## PUBLIC APPOINTMENTS

Applications are invited for pensionable posts as

**ASSISTANT EXAMINERS**

in the

**PATENT OFFICE**

to undertake the official scientific technical and legal work in connection with Patent Applications. There are a small number of similar posts in the Ministry of Supply. Applications may be accepted up to 31st December, 1955, but early application is advised as an earlier closing date may be announced. Interview Boards will sit at frequent intervals.

CANDIDATES must be between 21 and 28 years of age during 1955 (up to 31 for permanent members of the Experimental Officer Class) and have First or Second Class Honours degree in physics, chemistry, mechanical or electrical engineering, or mathematics. Candidates taking their degrees in 1955 may apply before the result of their degree examination is known.

STARTING emoluments in London, including Extra Duty allowance for 45½ hour week, between £532 and £729 (men) £642 (women) according to periods of National Service and post-graduate experience rising to £896 (men) and £799 (women). Promotion to Examiners—£934 to £1,279 (men), £820 to £1,144 (women); normally after 5 years (3 or 4 years in exceptional cases). Women's scales subject to increase under equal pay scheme. Good expectations of promotion to Senior Examiner. Candidates are recruited by selective interview.

APPLICATION forms and further information from the Civil Service Commission, Scientific Branch, 30 Old Burlington Street, London, W.1, quoting number S 128/55. [3788

## PACKING AND SHIPPING

**R.** and J. PARK, LTD., 143-9 Fenchurch St., E.C. Tel.: Mansion House 3083. Official Packers and shippers to the aircraft industry. [0012

EXPORT PACKING SERVICE, LTD., Imperial Buildings, 56 Kingsway, W.C.2. Tel.: Chancery 5121-3. Scientific packers to the Services and industry. Specialists in the packing of aircraft and aircraft components. Approved packers for the Admiralty, A.I.D., I.P.V., C.I.A., C.I.S., I.E.M.S., M.o.S. and many foreign Government Departments. [0920

## TUITION

CIVIL Pilot/Navigation Licences.

AVIGATION, LTD., provides full-time or intermittent instruction and postal tuition, or a combination of any of these methods to suit individual requirements for the above licences. Instruction can be provided for A.R.B. General, certain specific types, and A.R.B. Performance Schedule examinations. Link-training Dept. (City 1162) situated centrally in London. Full briefing for I/R 25/- hr. Block rate (min. 10 hrs.) 22/6 hr.
For full details apply to: The Principal,
AVIGATION, LIMITED,
30 Central Chambers, Ealing B/way, London, W.5.
Tel.: EALing 8949. [0248

NIGHT FLYING
INSTRUMENT FLYING
TWIN CONVERSIONS
EVERY facility at reasonable rates from:—
SOUTHEND-ON-SEA MUNICIPAL AIR CENTRE and FLYING SCHOOL, Municipal Airport, Southend-on-Sea, Rochford 56204. [0452

LONDON SCHOOL OF AIR NAVIGATION
IN conjunction with
AIRWAYS AERO COMPANY, LTD.
OFFERS completely co-ordinated and integrated training for professional pilots/navigators.
M.T.C.A. approval for commercial pilots and instrument rating courses, also P.P.L. All ground and air subjects to U.K.'s application ICAO standards.
TRAINING focalised London.
FULL-TIME personal coaching Com./IR:Sen./Com: ALTP: F/Nav. Pungent and effective.
HOME study tutorial (correspondence) excellent alternative: full coverage: modern presentation: attractive terms.
LINK, briefing, procedures, airways; R/T.
TYPE rating, general, specific, per. schedules.
SUCCESSES highest in country. Re-habilitation from services to civil.
33 OVINGTON Sq., London, S.W.3. KEN. 8221. Flying Base: Croydon Airport. [0277

## APPLICATIONS ARE INVITED

from experienced

## AIRCRAFT DRAUGHTSMEN

for the design department of an expanding and progressive company where there are ample opportunities for advancement.

The design office is at present engaged upon a new civil aircraft and additional staff are required with the following experience at Southend-on-Sea.

**Aircraft Structures.**
**Fuel Systems.**
**Controls.**
**Radio.**
**Cockpit and Cabin Layout.**
**Engine Installation.**
**Hydraulic Systems.**
**Electrical Installations.**
**Air Conditioning.**
**Instrumentation.**

Applications are also invited from

**Senior and Intermediate Aerodynamicists and Intermediate Stressmen.**

Vacancies also exist at our

**STANSTED, ESSEX,** base for

## SENIOR DRAUGHTSMEN

with Electrical, Radio and Mechanical Engineering experience.

All applications to the

**Chief Designer,**
**AVIATION TRADERS (Eng.) LTD.**
**Municipal Airport,**
**SOUTHEND-ON-SEA, ESSEX,**

stating experience and salary required.

## TUITION

LEARN to fly for £26. Instructors' licences and instrument flying for £3/5/-per hour. Night flying £4/5/- per hour. Residence 5 gns. weekly. Approved M.C.A. private pilots' licence course. Specialized course for junior commercial pilot's licence. Wiltshire School of Flying, Ltd., Thruxton Aerodrome, nr. Andover, Hants. Tel.: Weyhill 352. [0253

AERONAUTICAL. Comprehensive full-time technical and practical training for careers in all branches of aviation engineering. Diploma course leads to interesting executive appointments in civil aviation design and development, draughtsmanship, maintenance, etc. Extended courses to prepare for A.F.R.Ae.S. and A.M.I.Mech.E. examinations. Write for prospectus to Engineer in Charge, College of Aeronautical Engineering, Chelsea, London, S.W.3. Flaxman 0021. [0019

## TUITION

A.F.R.Ae.S., A.R.B.Certs., A.M.I.Mech.E., etc., on "no pass, no fee," terms; over 95 per cent successes. For details of exams and courses in all branches of aeronautical work, navigation, mechanical eng. write for 144-page handbook free.—B.I.E.T. (Dept. 702), 29 Wright's Lane, London, W.8. [0707

FREE! Brochure giving details of courses in all branches aero eng. covering A.F.R.Ae.S., M.C.A., exam., etc. Also courses for all other branches of engineering.—Write: E.M.I. Institutes, Dept. F26, London, W.4. (Associated with H.M.V.) [0964

BRITAIN'S AIR UNIVERSITY CAN TRAIN YOU for an airline career. Hundreds of today's airline captains and key maintenance personnel are graduates of this famous establishment. Courses are available for Commercial and Airline Transport Pilots' Licences, Instrument Ratings and Maintenance Engineers' Licences.

FOR details of these and other courses, apply to:—The Commandant, Air Service Training, Ltd., Hamble, Southampton. [0970

## SITUATIONS VACANT

CAMBRIAN AIRWAYS require Foreman Inspector, Licensed Aircraft Engineer at Rhoose Airport to cover Dakota "A". Licence coverage "A" and "C" for Dakota, Dove and Rapide aircraft an advantage.

PERMANENT position. Salary to N.J.C. scale. Apply: Chief Engineer, at Rhoose Airport, S. Wales. Tel.: Barry 2100. [3762

ENGINEER with thorough experience on Viking aircraft and Bristol Hercules engines, preferably but not necessarily licensed, required as U.K. Technical Representative/Inspector. Only Engineers with initiative, knowledge of spares provisioning and office routine need apply.

AN opening also exists for a fully qualified and competent Chief Inspector to be based in Johannesburg.

TREK AIRWAYS, 29 Whitehall, London, S.W.1. Telephone TRAfalgar 4226. [3784


**MARSHALL**

**AIRPORT WORKS, CAMBRIDGE**

**AIRCRAFT DESIGN AND DRAWING OFFICE**

Have vacancies for:—

Four Draughtsmen (Senior)

Four Draughtsmen (Intermediate)

Three Stressmen

The Design and Drawing Office is engaged on modifications trial installations and development work, including radar and electronic installations. The work is on a wide variety of multijet aircraft, Turbo-Prop Airliners and Guided Weapons.

**EXCELLENT SALARIES AND LONG TERM PROSPECTS**

**MODERN OFFICE AND EQUIPMENT**

**HOUSING AVAILABLE**

Applications, with full details and stating when available for interview, to:—

**PERSONNEL MANAGER, AIRPORT WORKS, CAMBRIDGE**


## SITUATIONS VACANT

*The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.*

**BRISTOL WAYFARER**

1. Captain with A.L.T.P. and Instrument Rating required for interesting position in Beirut. 12 months contract renewable. Good allowances and pay depending on previous experience.

2. "A" and "C" licensed Engineer also required take charge of small maintenance party on similar terms and conditions.

APPLY Personnel Manager, Skyways, Ltd., 7 Berkeley Street, W.1. [3785

**£1000** P.A. Stressmen. Houses to rent. Box 4206. [3787

DRAUGHTSMEN required, capable taking charge of various aircraft installations, projects, details experience, qualifications to Airwork, Gatwick Airport, Horley, Surrey. [3732


**BROOKLANDS AVIATION LTD.**

**NORTHAMPTON**

*require*

**AIRFRAME FITTERS**

**INSPECTORS**

**and**

**RATEFIXER**

Preference given to Ex-R.A.F. and R.N.A.S. Technicians

Regular work with bonus and overtime

*Apply to:*

**BROOKLANDS AVIATION LTD., Buttocks Booth, Moulton, Northampton**



**GUIDED WEAPONS**

**TRIALS WORK**

The Guided Weapons Department of The Bristol Aeroplane Co., Ltd. at Filton has vacancies for two categories of staff engaged in Guided Weapons Trials Field Work.

**Applicants for the Senior Category** are expected to have an Engineering Degree and practical experience, or an equivalent professional qualification with extensive engineering experience in industry or the Services.

**Applicants for the less Senior Category** are expected to have a Higher National Certificate in Engineering or the equivalent and some engineering experience.

**The Duties** are Administrative and Technical in nature, and provide great scope for exercising a sense of responsibility. They will involve living away from base for short periods with the possibility of short terms abroad.

Good salaries appropriate to experience and qualifications are offered. Serving Officers, who are about to terminate their engagements are invited to apply for the Higher Category, which offers an exceptionally good opening with long-term prospects.

Applications, giving details of experience, qualifications and age, quoting D.O.38, should be addressed to the **Personnel Manager, The Bristol Aeroplane Co., Ltd., Aircraft Division, Filton House, Bristol.**



**GLOSTER AIRCRAFT CO. LTD.**

**GLOUCESTER**

HAVE VACANCIES ON SUPER-PRIORITY DESIGN AND DEVELOPMENT PROJECTS

*FOR*

**AIRCRAFT DESIGN DRAUGHTSMEN**

**(SENIOR & JUNIOR)**

Consideration will also be given to Draughtsmen with Mechanical, Structural or Electrical experience.

Also

**STRESSMEN**

**(SENIOR & INTERMEDIATE)**

for both strength and flutter calculations.

The conditions of employment are good with progressive salary, good sports and welfare facilities, pension scheme, etc.

APPLICATIONS STATING AGE, PREVIOUS EXPERIENCE AND EMPLOYERS SHOULD BE ADDRESSED TO THE

**CHIEF DESIGNER**

**THE HESTON AIRCRAFT CO. LTD.**

**HESTON AIRPORT, Hounslow, Middlesex**

have immediate openings in their

DESIGN OFFICE

on a new and interesting Civil Aeroplane for:

**SENIOR, INTERMEDIATE and JUNIOR DRAUGHTSMEN, LOFTSMEN, EXPERIENCED STRESSMEN**

LONG-TERM PROGRAMME. Good opportunities

Please write with full particulars to:
**THE CHIEF DESIGNER**



**THE LONDON DESIGN OFFICE of SHORT BROTHERS AND HARLAND LIMITED**

has the following vacancies:

1. **SENIOR STRESSMAN** with experience of the different aspects of aircraft stressing. This is a Senior Staff position affording considerable scope and requires a willingness to accept responsibility.

Qualifications: A degree in engineering or H.N.C. in relevant subjects.

2. **STRUCTURAL DRAUGHTSMEN** for work on fuselage, wings, etc.

The prospects for these classes are good, as is the pay, and the work is of great interest.

Applications, which will be treated strictly confidentially, giving full details, including salary expected, to

**The Manager, London Design Office SHORT BROTHERS and HARLAND LIMITED**
**208A, Regent Street, London, W.1,**
quoting S.A.67.


## SITUATIONS VACANT


**SKYWAYS LIMITED**

have vacancies at

**Bovingdon and Stanstead Airports**

for the following grades of personnel

**AIRCREW**

EXPERIENCED radio officers required immediately. Applicants must hold M.T.C.A. 1st Class Flight Radio Operators licence (temporary licence acceptable). Salary according to experience in scale £725—£1,140 p.a. Good allowances.

**GROUND ENGINEERS**

1. "X" licensed electrician, experienced on modern transport aircraft, preferably with licence valid for Hermes.
2. Engine and airframe charge hands, experienced as in (1) above, but licences not essential.
3. "X" licensed instrument mechanic, with licence valid for Hermes.
4. Airframe inspectors, preferably with "A" licence covering Hermes.
5. Stores inspector, familiar with A.R.B. or A.I.D. procedure.
6. Experienced engine and airframe fitters, aircraft electricians, instrument mechanics and radio mechanics.

BOVINGDON—all grades.
STANSTEAD—grades shown in section 6.

INTERESTING work on Hermes aircraft with good rates of pay and conditions.

APPLICATIONS giving full details of experience and qualifications should be addressed as follows:
For BOVINGDON—
Admin. Superintendent,
SKYWAYS, LTD.,
Bovingdon Airport,
Herts.
For AIRCREW and STANSTEAD—
Personnel Manager,
SKYWAYS, LTD.,
Stanstead Airport,
Essex. [3761

**AERODYNAMICISTS, PHYSICISTS, MATHEMATICIANS & ENGINEERS**

A RAPIDLY expanding aircraft instrument firm engaged on the design and development of auto-pilots for aircraft and helicopters has vacancies for the following:
(a) Stability and control analysis.
(b) Flight simulator assessment of aircraft stability.
(c) Aircraft flight trials of equipment.

PREVIOUS experience in the aerodynamics or flight test department of aircraft or guided weapon industry desirable but not essential.
(d) Testing and development of Electro-hydraulic servomechanisms.

PREVIOUS experience with hydraulics not essential. Good electrical knowledge is necessary. Duties will include testing equipment at hydraulic firms.

PLEASE apply giving full details of career and salary required (which will be treated in strict confidence) to: Personnel Officer, Louis Newmark, Ltd., Prefect Works, Purley Way, Croydon Surrey. [3800

**STRESSMEN**

A well known aircraft firm in the London area urgently requires:

**SECTION LEADER STRESSMEN**

and

**SENIOR STRESSMEN**

to work on an interesting programme of design on a new project.

These are responsible positions and will carry salaries of up to £1,100 p.a.

Write, giving full details of qualifications and experience to Box P.354 c/o 191 Gresham House, E.C.2. [3684

LOUIS NEWMARK, LTD., have a vacancy in their laboratories for a Physicist or Electro-mechanical Engineer for development work on aircraft and allied instruments. Applications are invited from persons with a degree or similar qualifications who have had some industrial experience preferably on work with gyroscopes or accelerometers. Good salary and prospects. Apply Personnel Manager, Louis Newmark, Ltd., Prefect Works, Purley Way, Croydon, Surrey. [3801

PRODUCTION Manager. Senior aircraft executive is required to fill the above position. Applicants should have had first-class experience in all aspects of production control, workshop techniques and modern manufacturing methods. It is imperative that applicants should be holding a similar position and seeking advancement. The successful candidate will be expected to reside in the Midland area and the appointment will carry a salary commensurate with the duties and responsibilities involved and is pensionable. Write giving qualifications, details of experience and salary required to Box F.516, L.P.E., 55 St. Martin's Lane, W.C.2. [3777



# FLIGHT ENGINEERS

required, preferably with "A" and/or "C" licences on Tudor aircraft.

Apply by letter in first instance giving full particulars to:—

**Operations Manager**
**Air Charter Limited**
**15, Gt. Cumberland Place**
**London, W.1**

Tel. Ambassador 2091



The Aircraft Division of The Bristol Aeroplane Company Limited is seeking to engage within its Sales organization gentlemen with personality between the ages of 23 and 40 years of above average intelligence and of good appearance, who are able to express themselves concisely and clearly.

Applicants should have engineering experience with preferably a University Degree or equivalent professional qualifications. The applicant must have experience of aviation matters gained in the Services, civil aviation or in the aircraft industry.

Good salaries and working conditions, together with the Pension, Life Assurance and Welfare Schemes make employment with this Company really worth while.

Applications should be made in writing to the

**PERSONNEL MANAGER**
**THE BRISTOL AEROPLANE COMPANY LIMITED**
**Aircraft Division**
**Filton House - - Bristol**

## SITUATIONS VACANT

LICENSED Inspector required with Instrument testing experience. Knowledge of A.I.D. procedure an advantage. Apply with full details: Repaircraft Services, Cranleigh: 536. [3799

SENIOR and Intermediate Aircraft Draughtsmen and Stressmen required for interesting project work with South Coast firm. Apply in writing to Box 4109. [3769

MIDLAND Aircraft firm has vacancies for capable Designer-Draughtsmen and Stressmen. If you have good qualifications and experience and are already earning at least £900 p.a., please send full details to Box 3773. [3696

REQUIRED immediately A. and C. licensed engineers for small charter company operating Rapide and Anson aircraft. Reply giving full details of licences held. State when available for interview in London. Box 4289. [3796

EDGAR PERCIVAL AIRCRAFT, LTD., require a Chief Inspector, and Inspectors at their works at Stapleford Tawney Aerodrome in Essex. Replies giving full details of experience and salary required must be addressed to the firm's London Office at 72 Chesterfield House, Curzon Street, London, W.1. [3802

TEST Engineers and Technical Assistants required for work on development of ground and flight refuelling components and installations. Applicants should possess general experience of mechanical engineering and preferably of fuel systems or servo mechanisms.

MATERIAL Test Assistants required for work on interesting programme of material testing.

ALL applicants should possess H.N.C. or equivalent. Pension and Insurance Schemes. Within easy reach of Bournemouth. Special transport facilities. Apply in writing to Personnel Manager, Flight Refuelling, Ltd., Tarrant Rushton Airfield, Nr. Blandford, Dorset. [3755

EDGAR PERCIVAL AIRCRAFT, LTD., require a Technical Writer experienced in small commercial aircraft, for the preparation of manuals of an aircraft now under construction, and for other interesting projects. Reply giving full details of experience and salary required to the firm's London Office at 72 Chesterfield House, Curzon Street, London, W.1. [3803

CHIEF Inspector required by firm of light hydraulic engineers. Applicant must possess thorough engineering background, and have had previous experience in administration and control of staff. A.I.D. and A.R.B. is required, therefore the applicant must be familiar with these conditions. Superannuation scheme. Salary will be commensurate with experience. Replies, which will be treated in confidence, should state age, experience and qualifications, and addressed to the Chief Engineer, Telehoist Limited, Cheltenham. [3795

## THE BRISTOL AEROPLANE COMPANY LIMITED

**ENGINE DIVISION**

have vacancies in their

**TEST PLANT DESIGN DRAWING OFFICE**

in

**MAYFAIR, LONDON and BRISTOL**

for

**DRAUGHTSMEN**

with experience in any branch of Mechanical Engineering.

Attractive salaries and a comprehensive Pension Scheme.

Luncheon voucher scheme.

**INTERVIEWS**

will be arranged in London or Bristol, weekdays or weekends.

Applications, quoting E.D.40, giving details of age, qualifications and experience, for London or Bristol, should be addressed to the **Personnel Manager, The Bristol Aeroplane Co., Ltd., Engine Division, Filton House, Bristol.**

## SITUATIONS VACANT

BLACKBURN & GENERAL AIRCRAFT, LTD., Brough, E. Yorks, require Female Staff to be trained for the Computing Section of their Technical Design Office. The educational qualifications required are G.C.E. advanced, i.e. Inter B.Sc. level or passed Degree level for the Senior positions and G.C.E. for the Junior. The work requires reasonably intelligent understanding of mathematical symbols, the use of logarithms and trigonometrical functions. This is an opportunity for girls with the right educational qualifications to enter the technical side of the Aircraft industry. Applications in writing please to the Personnel Manager at the above address. Mark envelopes—"Computer". [3794

BRITISH PETROLEUM COMPANY LIMITED has a vacancy for a Deputy to the Manager of their Travel and Employee Services Branch at the Head Office in London. Applications are invited from men aged 30-35 with first class experience in Air Line, Shipping Company, or Travel Agency work. Service overseas, particularly in the Middle East, an advantage. An Arts Degree together with knowledge of one or more European languages desirable but not essential. Good prospects, excellent pension scheme. Salary according to qualifications and experience. Applications giving age and full details of qualifications and experience should be addressed, quoting H.3283, to Box 7629, c/o 191, Gresham House, E.C.2. [3786

BRITISH OVERSEAS AIRWAYS CORPORATION have vacancies for Engineer Officers (Flight Engineers). Applicants must be between 21 and 33 years of age, of a high standard of physical fitness and educated to School Certificate standard. The qualifications required are 5 years' experience in aircraft maintenance including both airframes and engines on four-engined aircraft or an apprenticeship in aeronautical engineering with an additional 2 years' practical experience or 2 years' experience as a Pilot or Flight Engineer on 4-engined aircraft with adequate practical experience in addition. Desirable additional qualifications are the possession of Maintenance Engineer's Licence in categories A and/or C on 4-engined aircraft and in any case applicants will be expected to have the technical knowledge necessary to obtain such licences. Successful candidates will be appointed for a probationary period which will include training to enable them to obtain the Flight Engineer's "O" Licence, and during this time a salary within the range of £625/675 per annum will be paid. On confirmation as an Engineering Officer a commencing salary of £805 per annum will be paid, rising to a maximum of £1,345 per annum. Applications should be addressed to the Chief Personnel Officer, B.O.A.C., Airways House, Great West Road, Brentford, Middlesex. [3750

## AVRO AIRCRAFT LIMITED

**TORONTO ONTARIO CANADA**

have vacancies for:

**AERONAUTICAL ENGINEERS**
holding B.Sc., H.N.D., or H.N.C.

**AIRCRAFT DESIGNERS**
holding H.N.C. and 5 years' actual experience

**SENIOR DRAUGHTSMEN**
who have had 5 to 10 years' actual experience

in the following fields:

**1. AIRFRAME DESIGN**
**2. AIRFRAME STRESSING**

Good conditions of employment; paid vacations; five-day week; group life, accident and sickness insurance plan; pension scheme after a qualifying period of service, financial assistance to successful applicants.

Those with the necessary qualifications and interested in emigrating to Canada please apply to

**Avro Aircraft, Limited, Dept. 12, c/o 12 New Burlington Street, London, W.1.**

## SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT LTD.

## ARMAMENTS DIVISION

The following senior posts are available to candidates with suitable qualifications and experience to undertake design and development work in guided missiles.

**SENIOR ELECTRONIC ENGINEER**
**SENIOR MECHANICAL ENGINEER**
**SENIOR TRIALS ENGINEER**
**SENIOR STRUCTURAL ENGINEER**

All the above posts are for senior engineers on the monthly staff of the firm and will carry good salaries and excellent prospects. Assistance can be given to housing selected applicants.

Apply to:

**CHIEF ENGINEER, ARMAMENTS DIVISION,**
**SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT LTD.,**
**BAGINTON, NR. COVENTRY.**

## SITUATIONS VACANT

EAST AFRICAN AIRWAYS require pilots in the grades of Captain, First Officer and Second Officer. Dakota experience desirable. Applicants should reply giving age and details of flying experience to the Deputy Operations Manager, East African Airways Corporation, P.O. Box 1010, Nairobi, Kenya, East Africa. [3733

APPLICATIONS are invited for an executive position with a firm of high standing in the Aeronautical Industry. Applicants should have a good working knowledge of aircraft electrical components and spares, and be familiar with current market prices coupled with some sales ability. Box 4207. [3790

AQUILA AIRWAYS have immediate vacancy for two First or Second Officers. Pilots with flying boat experience will receive preference but the right type of young pilot with land plane experience would be considered. Apply managing Director, Aquila Airways, Ltd., 1 Great Cumberland Place, London, W.1. [3789

MAINTENANCE test pilots required for flying duties in various parts of the country. Applicants need not be in possession of civil licences but must be widely experienced on single, twin and jet engined aircraft. Write giving complete breakdown of flying experience with hours on each type of aircraft to Airwork, Ltd., Flying Training Division, Sutton Lane, Langley, Bucks. Langley 520 [3805

ASSISTANT Chief Inspector required in London for a company manufacturing electro-mechanical devices for the Aircraft Industry. Consideration will be given to applicants under 40 who should be of Degree or H.N.C. standard familiar with A.I.D. procedure and Quality Control. The appointment has attractive prospects for promotion. Apply giving full details of age and experience in strict confidence to Box 3968. [3739

## SITUATIONS VACANT

EDGAR PERCIVAL AIRCRAFT, LTD., require Senior and Intermediate Draughtsmen for interesting work on a small commercial aircraft, and for other projects at both Stapleford Tawney Aerodrome in Essex, and at their London (S.W.) drawing office. Replies giving full details of experience and salary required must be addressed to the firm's London Office at 72 Chesterfield House, Curzon Street, London, W.1. [3804

SENIOR and Intermediate Design Draughtsmen with aircraft and mechanical engineering experience required. The work will interest men who can apply their design ability to the development of new equipment which has a steadily growing application. Pleasant working conditions. Pension and Insurance Schemes. Limited accommodation available. Within easy reach of Bournemouth. Special transport facilities. Apply in writing to Personnel Manager, Flight Refuelling, Ltd., Tarrant Rushton Airfield, Nr. Blandford, Dorset. [3756

## SITUATIONS WANTED

P.P.L. holder, age 27, variety light singles, 100 hours • PII heavy twins, 8 years aircraft maintenance. Seeks position involving flying, anything considered. Taking commercial licence when eligible. Box 4208 [3791

COMMERCIAL Pilot, R.T. and instrument rating. 730 hrs. Twin and single engined experience, age 26, British, seeks position—any country. Phone Locksheath (Hants) 3262. Alternative Bexhill-on-Sea 976. Write: Evergreen, Locksheath Park Road, Locksheath, Nr. Southampton, Hants. [3759

## BOOKS, ETC.

THE Flight of Alcock and Brown—the story of the Transatlantic Flight of 1919. 312 pages, many illustrations. Price 18/7 post free. Get your copy now from Beaumont, Aviation Bookseller, 59 Russell Road, Forty Hill, Enfield, Middx. Full booklist available for 2½d. stamp. [3793

"MATERIAL Handling in Works Stores," 2nd Ed. by L. J. Hoefkens. Shows how the use of fork-lift trucks and pallets in industrial stores can increase production, utilize floor space more effectively, help control of movement and reduce costs. Includes a description of a system actually operated in a modern factory. 18s. 0d. net from all booksellers. By post 18s. 6d. from Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1.

"MOTOR Cycle Sport in Pictures: Action Photographs of British and International Racing Trials, Scrambles and Speedway Events." Contains over sixty of the finest photographs of motor cycle sport ever taken, each picture having been specially selected by the Editor of "The Motor Cycle." A superb volume, beautifully printed, which at its price represents first-class value. 3s. 6d. net from all booksellers. By post 3s. 9d. from Iliffe & Sons, Ltd., Dorset House, Stamford St., London, S.E.1.

"MECHANICS for the Home Student," by Eric N. Simons, in association with W. D. Burnet, B.Eng., Lecturer in Mechanical Engineering at Sheffield University. The nineteen chapters of this practical book provide an excellent introduction to the subject under such headings as action, force, momentum, power, applied force, friction, centre of gravity, density, fluids, gases, heat, vibration, stress, impact, rotation, etc. 7s. 6d. net. from all booksellers. By post 7s. 10d. from Iliffe & Sons, Ltd., Dorset House, Stamford St., London, S.E.1.


**MARSHALL**

**AIRPORT WORKS, CAMBRIDGE**

SKILLED AIRCRAFT ELECTRICIANS
AIRFRAME FITTERS
AIRCRAFT INSPECTORS
SKIN REPAIRERS

Required for work on a variety of multi-jet and turbo-prop Service and Civilian Aircraft. A few vacancies are available in all trades in Experimental and Development Section.

Accepted applicants will be paid subsistence allowances if maintaining a home outside the Cambridge area.

Comfortable hostel accommodation (single or double cubicle) with good food available at Works. Alternative private lodgings on nearby housing estate on City bus route.

Applications, with full details, in first instance, to:—

**EMPLOYMENT OFFICER, AIRPORT WORKS, CAMBRIDGE**

**HUNTING-CLAN**

**AIR TRANSPORT LIMITED**

*require*

**FLIGHT RADIO OFFICERS**

**for their VIKING, YORK, DAKOTA and VISCOUNT fleets**

Minimum qualifications are

**FIRST CLASS FLIGHT RADIO OPERATOR'S LICENCE**

as issued by M.T.C.A.

*Reply:*

**BASE MANAGER**
**HUNTING-CLAN AIR TRANSPORT LTD.**
**London Airport, Hounslow**
**MIDDLESEX**

**HUNTING PERCIVAL AIRCRAFT LTD.**

Invite applications from the following

**TECHNICAL PERSONNEL**

to work on interesting and progressive development programmes on Civil and Military Aircraft.

**The scope of work covers the initial design, development and production-ising of both fixed and Rotating Wing Jet Aircraft and other projects.**

**SENIOR and INTERMEDIATE DESIGN DRAUGHTSMEN**

With structural or mechanical experience.

**SENIOR and JUNIOR STRESSMEN**

With Engineering Degree, H.N.C. or similar qualification.

Aircraft experience an advantage but not essential for these positions.

**FLIGHT TEST TECHNICIANS**

Experienced in Flight Test reduction and analysis.

These are permanent and progressive posts for the right man and promotion prospects are good.

Employment conditions are good including Pension and Life Assurance scheme.

Assistance is given in obtaining single lodging accommodation within easy reach of the works and there is the possibility of assistance with housing on long-term basis.

Applications to:—

**The Personnel Manager,**
**THE AIRPORT, LUTON, BEDS.**

**SHORT BROTHERS & HARLAND LIMITED**

There is an immediate vacancy in the

**AERODYNAMICS DEPARTMENT**

for a **TECHNICIAN** for work on problems of the performance of radical new types of aircraft.

**Qualifications:** Minimum—H.N.C.

**Experience:** at least three years in an Aerodynamics office on similar work.

Knowledge of supersonics an advantage.

The department is expanding as are the opportunities.

Assistance with housing and with removal expenses.

The Appointment is permanent and pensionable.

Interviews either in London or Belfast.

Applications will be treated in the strictest confidence and should be made to Staff Appointments Officer, P.O. Box 241, Belfast, quoting S.A.55.

## ARE YOU INTERESTED IN BECOMING AN IMPORTANT MEMBER OF A SMALL DESIGN TEAM?

If you are keen, full of initiative and can follow your own designs from a blank sheet of paper to the finished product, we have a permanent post at an attractive salary for you.

The machines we are working on are *not* supersonic, but they are new, different and full of interest for trained and capable men.

The steps already taken to fulfil our modern policy of designing aircraft for specialised world markets have opened up the following vacancies:—

**SENIOR DESIGNER-DRAUGHTSMEN**
(For all aspects of Airframe Design)

**ASSISTANT CHIEF STRESSMAN**

**SENIOR STRESSMEN**
(For work on simplified structures, either wings or fuselages)

**AERODYNAMICISTS**

**PLASTICS DEVELOPMENT ENGINEER**

**TECHNICAL AUTHOR** **TECHNICAL ARTIST**

If you are seeking the type of position we have to offer, let us have details of your qualifications, experience and present salary. The higher paid posts will be on the monthly staff, leading to employment contracts if desired.

Assistance with house purchase for senior men. Contributory Pension Scheme.

Write in the first instance to Personnel Manager,
**AUSTER AIRCRAFT, LTD.,**
**REARSBY, LEICESTERSHIRE**

THE **NAVIGATOR'S SLIDE RULE**

A **NAVIGATIONAL COMPUTOR** AND **SLIDE RULE IN ONE**

*SPECIALLY DESIGNED FOR FLIGHT PLANNING AND NAVIGATION*

Including special scales for computing course and ground speed, air speed and altimeter corrections, density altitude, conversion to metric units, etc., in addition to the standard A.B.C.D. and trigonometrical scales. Invaluable to all navigators and candidates for M.C.A. Examinations. (Full instructions with each rule).

B·R·L **BLUNDELL RULES LTD.**
**CHAUL END LANE, LUTON, BEDS.**

THE

# DE HAVILLAND ENGINE CO. LTD

has vacancies for

## TECHNICAL ASSISTANTS

With experience in Development, Stress, Weight Control, Performance or Installation work

Successful applicants will be engaged in our

**EXPERIMENTAL DIVISION**

in interesting work on new projects

*For further details, please write giving qualifications and full details of previous experience to:*

**The Personnel Officer,**
**The de Havilland Engine Co. Ltd.**
**Stag Lane · Edgware · Middlesex**

## *REDUCE OPERATING COSTS...*

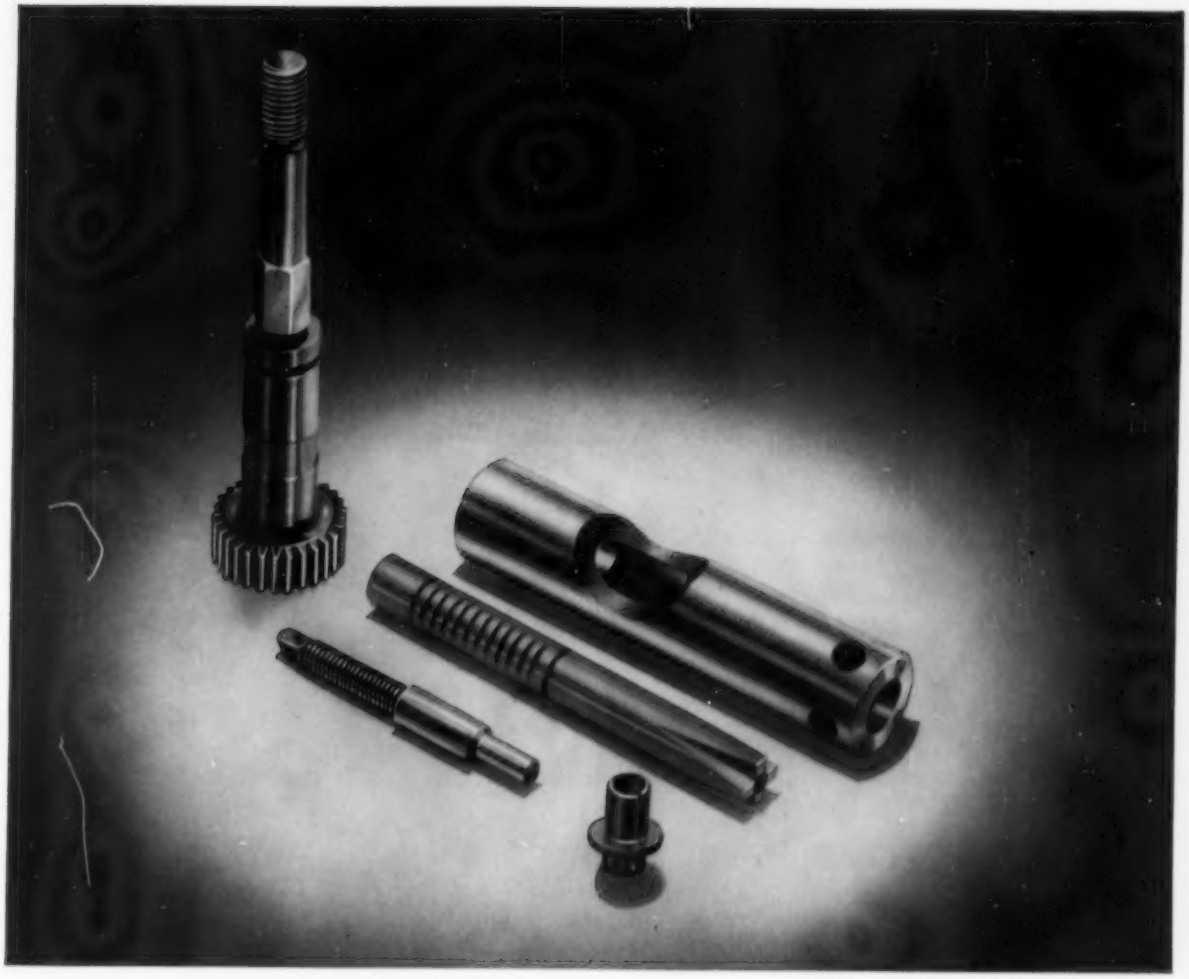
*Streamline Filters enable high grade oil to be used over and over again, thus helping to solve the problem of maintaining maximum efficiency at minimum cost.*

*Streamline* **FILTERS**
INGATE PLACE, LONDON, S.W.8
phone MACAULAY 1011


## INDEX TO ADVERTISERS


| | Page |
|---|---|
| Aero Maintenance Equipment, Ltd. | 28 |
| Aero Research, Ltd. | 18 |
| Aeroservices, Ltd. | 28 |
| Air Charter, Ltd. | 33 |
| Armstrong Whitworth Aircraft, Ltd., Sir W. G. | 34 |
| Aston and Co., Ltd., E. S. | 28 |
| Atlantic Aviation, Inc. | 28 |
| Auster Aircraft, Ltd. | 36 |
| Aviation Traders, Ltd. | 31 |
| Avro Aircraft, Ltd | 34 |
| Blackburn and General Aircraft, Ltd. | Cover i |
| Blundell Rules, Ltd. | 36 |
| Boulton Paul Aircraft, Ltd. | 7 |
| Box No. AC 06682 | 30 |
| Bristol Aeroplane Co., Ltd., The | Cover iv, 30, 31, 32, 33, 34 |
| British Air Line Pilots' Association, Ltd. | 28 |
| British Oxygen Co., Ltd. | Cover ii |
| "British Plastics" | 27 |
| Brooklands Aviation, Ltd. | 32 |
| Carruthers, Inc., Clarence | 28 |
| Cross Manufacturing Co. (1938), Ltd. | 28, 29 |
| De Havilland Engine Co., Ltd., The | 36 |
| Decca Navigator Co., Ltd., The | 2 |
| Dowty Equipment, Ltd. | 24 |
| Dzus Fastener Europe, Ltd. | 4 |
| Electro Hydraulics, Ltd. | 12 |
| Esso Petroleum Co., Ltd. | 11 |
| Fairey Aviation Co., Ltd., The | 15 |
| Feltham and Son, Ltd., Walter H. | 28 |
| Field Aircraft Services, Ltd. | 29 |
| Fishers | 29 |
| Fokker Aircraft | 19 |
| Gloster Aircraft Co., Ltd. | 23, 32 |
| Godfrey and Partners, Ltd., Sir George | 20 |
| Headquarter and General Supplies, Ltd. | 29 |
| Heston Aircraft Co., Ltd., The | 33 |
| Hobson, Ltd., H. M. | 5 |
| Hordern Richmond (Sales), Ltd. | 25 |
| Hunting-Clan Aircraft, Ltd. | 35 |
| Hunting Percival Aircraft, Ltd. | 17, 35 |
| Iliffe and Sons, Ltd. | 8, 26 |
| Lansing Bagnall, Ltd. | 31 |
| Laycock Engineering, Ltd. | 6 |
| Lewis, Ltd., D. | 29 |
| Leytonstone Jig and Tool Co., Ltd. | 4 |
| Lucas (Gas Turbine Equipment), Ltd., Joseph | Cover iii |
| Maricon, Ltd. | 25 |
| Marshall's Flying School, Ltd. | 32, 35 |
| Martin-Baker Aircraft, Ltd. | 16 |
| "Motor Cycle, The" | 8, 26 |
| Opperman, Ltd., S. E. | 26 |
| Roe and Co., Ltd., A. V. | 10 |
| Rolls-Royce, Ltd. | 13 |
| Rotol, Ltd. | 22 |
| Rozalex, Ltd. | 28 |
| Rumbold and Co., Ltd., L. A. | 21 |
| Sabena | 26 |
| Sankey and Sons, Ltd., Joseph | 8 |
| Saunders Valve Co., Ltd. | 9 |
| Shell Mex and B.P., Ltd. | 14 |
| Short Brothers and Harland, Ltd. | 3, 30, 33, 35 |
| Staines and Partners, Ltd., J. R. | 29 |
| Streamline Filters | 36 |
| Teddington Aircraft Controls, Ltd. | 6 |
| Vickers-Armstrongs, Ltd. | 1 |
| Wilson and Sons (London), Ltd., W. | 27 |


Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by SUN PRINTERS LTD., London, and Watford, Herts. *Flight* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd.; Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd.; Wm. Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co. Entered as Second Class Matter at the New York, U.S.A., Post Office.



Fuel flow is controlled by the throttle vaive components which are of high accuracy and surface finish within twenty-millionths of an inch.

*FUEL AND COMBUSTION SYSTEMS FOR GAS TURBINE ENGINES*

**LUCAS**

JOSEPH LUCAS (GAS TURBINE EQUIPMENT) LTD., BIRMINGHAM & BURNLEY

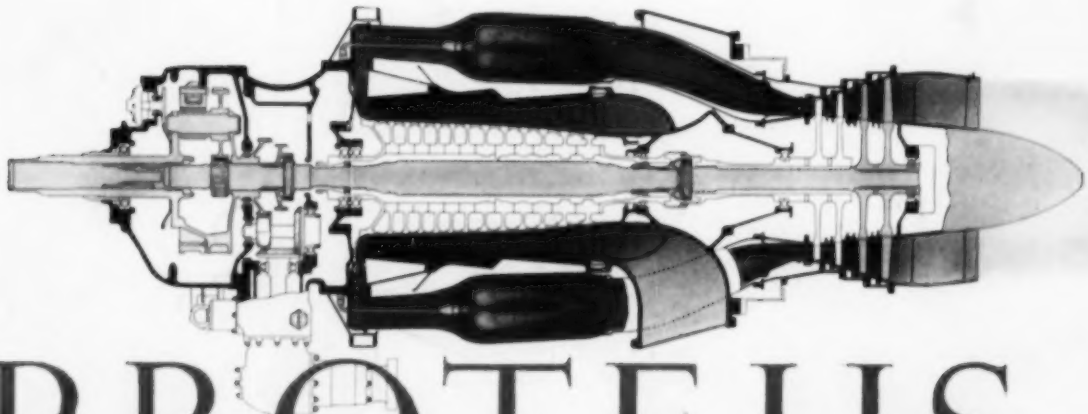
Lucas-Rotax (Australia) Pty. Ltd., Nepean Highway, Cheltenham S22, Victoria, Australia.
Lucas-Rotax Ltd., Scarborough, Ontario, Canada.

FLIGHT
3 June 1955

# *Power for the Britannia*

The first turboprop engine built by the Bristol Aeroplane Company was flown in February 1947. Since that date, Bristol has accumulated more experience with turboprops for large civil airliners than any other manufacturer.

The Bristol Proteus, now in production for the Britannia, has been fully type-tested, and officially given unrestricted clearance for use in passenger-carrying civil aircraft. No other high power turboprop in the world possesses this distinction.



# PROTEUS

3528

THE Bristol AEROPLANE COMPANY LIMITED ENGLAND